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ABSTRACT

This catalog lists resource materials for energy and environmental education which are available to Minnesota secondary teachers. The listings include both curricular resources with lesson plans and objectives, and noncurricular resources such as books, pamphlets, posters, audiovisual resources, and facilities for environmental education. The catalog is divided into three main sections: Energy Education Curriculum Resources, Environmental Education Curriculum Resources, and Noncurricular Resources. All listings are indexed by title and by supplier. Furthermore, the curriculum resources included in this catalog describe the subject areas (language arts, mathematics, drama, social science, art, and music) into which they can be integrated for classroom uses. (JJK)

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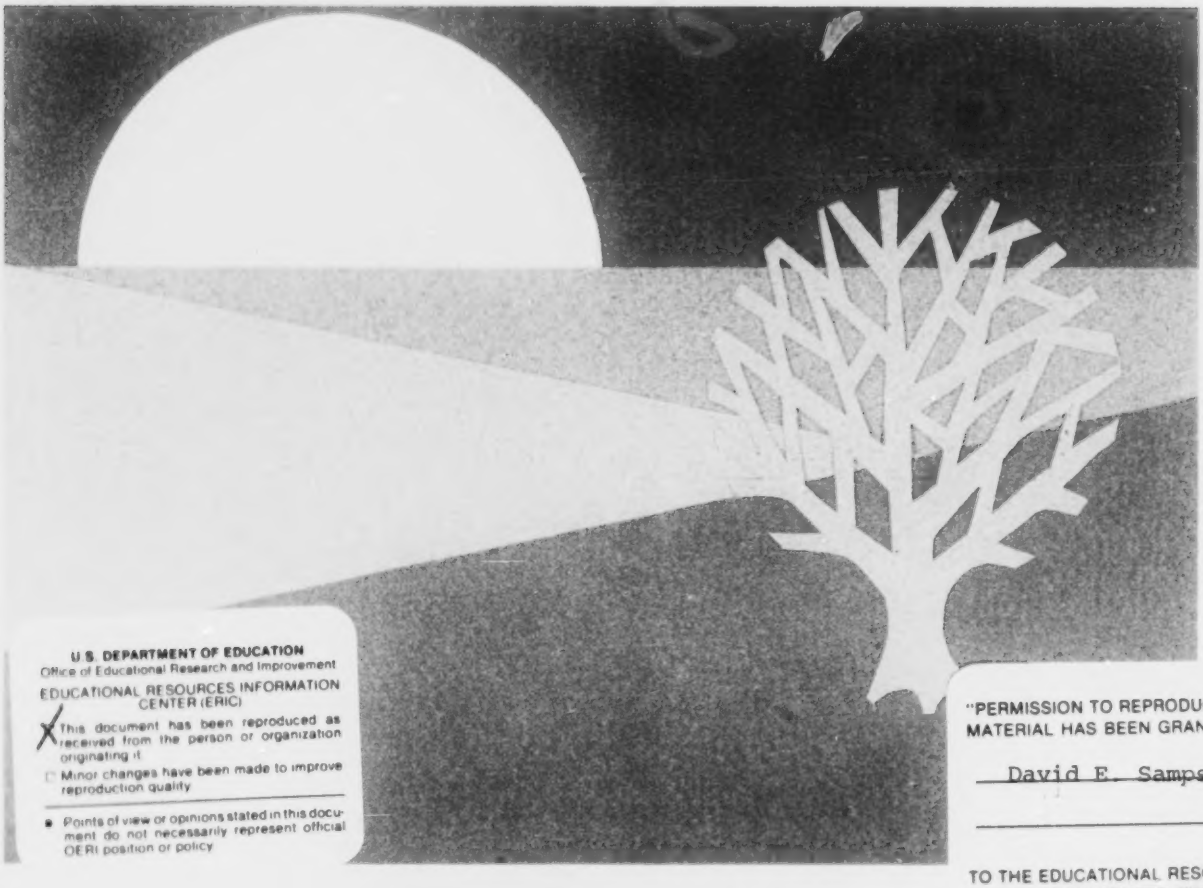

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CATALOG OF ENERGY AND ENVIRONMENTAL EDUCATION RESOURCES

DEPARTMENT OF PUBLIC SERVICE-ENERGY DIVISION
MINNESOTA ENVIRONMENTAL EDUCATION BOARD
MINNESOTA DEPARTMENT OF EDUCATION

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June 1989

INTRODUCTION

This is a catalog of Energy and Environmental Education Resources which are available to Minnesota secondary teachers. The listings include both curricular resources with lesson plans and objectives and noncurricular resources such as books, booklets, audiovisual resources, and facilities for environmental education. It is the first catalog of resources for secondary teachers.

This edition of the catalog is prepared by:

Minnesota Department of Public Service: Energy Division

Additional support and distribution comes from:

Minnesota Environmental Education Board
Minnesota Department of Education

Because of the importance of energy use and education, a separate section lists those resources. Since the 1970's it has become apparent that the use of fossil fuels will eventually need to be restricted if for no other reason because of their finite supplies. More recently other effects of combustion have become evident which suggest further caution in the use of fossil fuels. Acid precipitation and the depletion of the ozone layer are but two important environmental side effects of our energy usage.

Since 1986 environmental education has been a required offering in elementary schools in Minnesota. We can anticipate the same requirement will be made for secondary schools in the state. Because energy and environmental education covers a broad spectrum of subjects we can further anticipate that these studies be integrated or infused into other required curriculum offerings. This means that environmental education becomes a part of language arts, mathematics, drama, social science, art, and music just as it is a part of science. The curriculum resources included in this catalog list the subject areas into which they can be integrated.

The catalog is divided into three main sections: Energy Education Curriculum Resources, Environmental Education Curriculum Resources, and Noncurricular Resources. All listings are indexed by title and by supplier. An effort has been made to make sure that all materials included are indeed available and prices, addresses, and phone numbers are current.

Contacts have been made with over 200 suppliers of energy and environmental education resources for inclusion in this catalog. A good sampling of these is included. There are, however, many more which could be included. There are also new materials being developed and old favorites going out of print. For this reason, sponsors of the catalog are asking the users to help with the update of it. Please notify the principal sponsor of any new materials

you come across or any items which are included and are not available. Please send this information to:

Minnesota Department of Public Service
Energy Division
900 American Center Building
150 E. Kellogg Boulevard
St. Paul, MN 55101

If you have any questions or comments regarding any of the items listed in the catalog, please contact the supplier. Addresses and phone numbers are included in most cases.

This catalog has been compiled, edited, and prepared by Harry L. Buck, Environmental Education Consultant, and Katie Buck, Production Assistant, Rochester, MN. Cover graphics are by Molly K. Buck, Graphics Artist, Eagan, MN.

PARTICIPATING ORGANIZATIONS

MINNESOTA DEPARTMENT OF PUBLIC SERVICE: Energy Division
900 American Center Building
150 East Kellogg Boulevard
St. Paul, MN 55101
(612)297-1771

The Department of Public Service administers or participates in a wide range of activities to help assure the availability of energy resources at a reasonable cost and to help consumers improve energy efficiency and reduce energy costs.

The Energy Division provides energy information and technical assistance to a wide variety of consumers; administers financing of conservation improvements for public facilities; and carries out other responsibilities to encourage cost-effective improvements in energy efficiency and long term development of alternative energy resources.

THE MINNESOTA ENVIRONMENTAL EDUCATION BOARD
Box 5 DNR Building
500 Lafayette Road
St. Paul, MN 55155
(612)296-2368

The Minnesota Environmental Education Board (MEEB) is a state agency composed of 13 Regional Councils whose 200 citizen volunteers and five staff coordinators actively plan and conduct 240 environmental education programs reaching over 280,000 adults and students each year. Programs include major conferences; teacher workshops and public seminars; field activities and public exhibits; publications; and traveling environmental learning kits. MEEB coordinates programs with 100 local, state, and federal organizations. It was established by the legislature in 1973 and is administratively attached to the State Planning Agency.

MINNESOTA DEPARTMENT OF EDUCATION
644 Capitol Square Building
St. Paul MN 55101
(612)296-4069)

The Environmental Education program provides curriculum materials, services, and technical assistance to educators and their students throughout Minnesota. Services include: curriculum development/integration/planning; preservice/inservice workshops; site planning/-development; instructional materials design/development/implementation; environmental education learner outcomes; environmental education scope and sequence technical assistance; environmental education evaluation; environmental education review process and K-12 coordination; residential learning center programs; outdoor education programs; allied agency/organization linkage/services/resources and educational statute/rule clarification. Nearly 2200 educators representing all of Minnesota's public and nonpublic schools are part of an environmental education communications network that disseminates resource materials and information via direct mailings six times per year and voice mail upon request.

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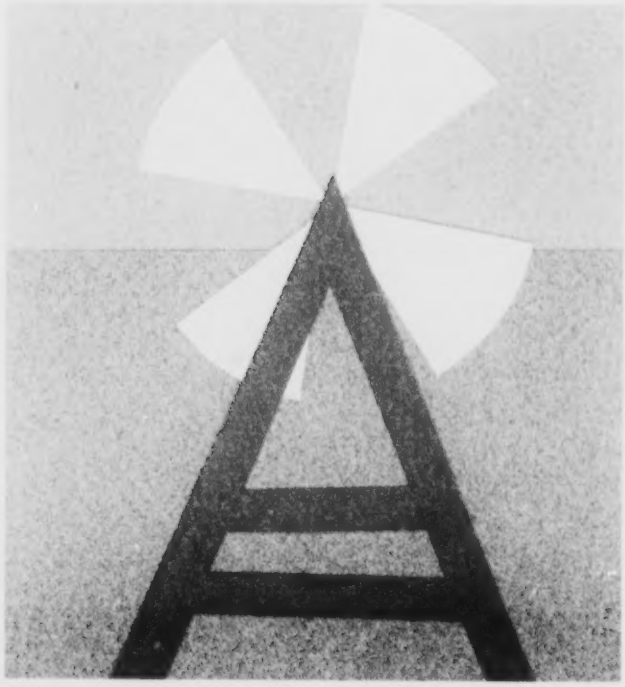
ENERGY



RESOURCES

SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Acid Rain Curriculum: Grades 4-8

STATED GOAL:

To provide learning activities on the problems of Acid Rain.

FORMAT:

Twelve interdisciplinary activities including lesson plans and student pages. Subjects of Science, Math, Social Science, Art, and Language Arts. Includes information, poster, and pH paper.

AVAILABILITY:

Cost: $23.95, prepaid only. Available from:
The Acid Rain Foundation
1410 Varsity Dr.
Raleigh, NC 27606
(919)828-9443

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Because of the nature of the subject all of the contexts are addressed in this material.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Social Science, Science, Math, Language, Art

Acid Rain Curriculum
Grades 4-8

Interdisciplinary Activities
Complete with lesson plans and student pages.

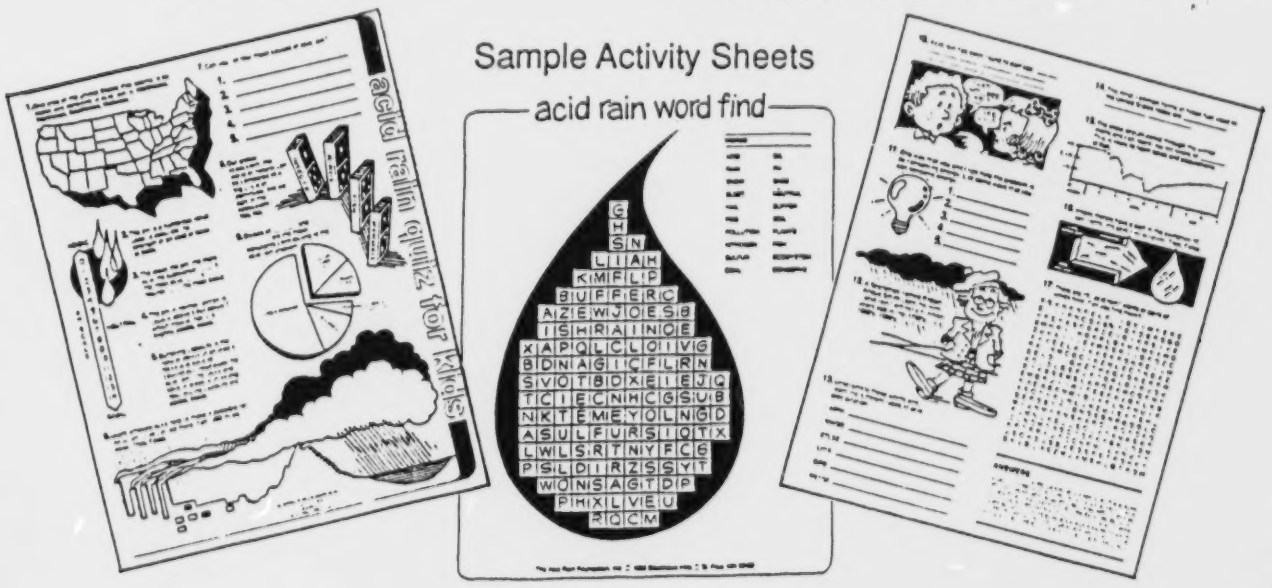
To be infused into existing science, math, social studies, art, or language arts curriculum - or taught as an acid rain unit.

- Air Pollution Collage
- Aquatic Organisms
- Cartoons
- Fossil Fuels
- Futures Wheel
- Letter Writing
- Logarithmic pH Values
- Measuring pH of Rain
- Measuring pH of Snow
- Neutralizing
- pH Scale
- Sources of Acid Rain

Plus These Additional Materials

- Acid Rain Quiz for Kids
- Acid Rain Word Find
- Booklets for Background Information
- Evaluation Sheets
- Infusion Chart, Elementary Acid Rain Curriculum
- Poster
- Wide range pH paper and color charts

Sample Activity Sheets



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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Acid Rain in Minnesota, Teacher's Resource Guide

STATED GOAL:

To provide learning activities to accompany Acid Rain in Minnesota, a booklet by The Acid Rain Foundation, MN PCA, DNR, Dept. of Health, and Dept. of Education.

FORMAT:

Seventeen interdisciplinary activities in Economics, Literature, Government, Environmental Studies, Speech, and Drama, to accompany Acid Rain in Minnesota, 1985.

AVAILABILITY:

Cost: $10, prepaid only. For Teacher's Guide and Acid Rain in Minnesota. Available from:
The Acid Rain Foundation
1410 Varsity Dr.
Raleigh, NC 27606

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Because of the nature of the subject all of the contexts are addressed in this material.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Social Science, Speech, Drama

STUDENT

ACID RAIN ECONOMICS

1. Economics is the study of

   a. choices
   b. money
   c. scarcity
   d. resources
   e. all of the above

2. What are the basic economics involved in the acid precipitation issue?

3. The 'cost of economics has seemed good' is one of the fundamental concepts of economics. You probably know the term as "trade-off". Essentially, this means that in deciding to produce one thing, the opportunity to produce something else disappears. List some "trade-offs".

   1. _____ 2. _____ 3. _____

4. What are some reasons people disagree over the use of money?

5. How does Acid Rain affect interdependence? Why is interdependence important? How does acid rain affect this?

6. Acid rain economics is the study of

   a. choices
   b. money
   c. scarcity
   d. resources
   e. all of the above

STUDENT

ARGUMENTS ABOUT ACID RAIN

In your study of acid rain you will read and hear many statements. You will probably come to some conclusions of your own about them. How do you go about deciding whether or not a particular problem is in fact a problem? Before you read some statements about acid rain, answer this question: What kind of evidence would I want to help me decide whether acid rain is/is not a problem?

Pick one of the following statements or one which your teacher assigns or, preferably, one which you have read/heard and analyze it. Where possible, be sure to include the source. You may find it useful to think of the statements as hypotheses to be tested.

How can you check the accuracy of the statement in question? Some of the sources to which you can turn for help include: encyclopedia or other specialized books, library, **Reader's Guide**, newspaper, human resources (specialist in community/letter to specialists), government, etc.

STATEMENTS: Acid rain is not good for the environment.

or

Current evidence on acid rain is incomplete.

or

Rushing into additional costly and complex regulations at this time would only cause confusion with no certainty of any positive effect on air quality or other environmental considerations.

"Clean Air Act and Industrial Growth, An Issue Workbook for the 97th Congress" National Environmental Development Association

or

It is very difficult for me to tell you that if you control SO_2 (sulfur dioxide) by 50 percent you will see any effect any place downwind.

Dr. Kenneth L. Demerjan, Environmental Protection Agency Testimony, Senate Environment and Public Works Committee

SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Acid Rain Learning Materials: Science, Environmental, and Social Studies, grades 7-12

STATED GOAL:

To provide users with information on the problems of Acid Rain.

FORMAT:

Loose leaf units (3-hole punched) for use in: Life Science, Earth Science, Physical Science, Biology, Chemistry, and Social Science

AVAILABILITY:

Cost: $55, prepaid only. Available from:
The Acid Rain Foundation
1410 Varsity Dr.
Raleigh, NC 27606
(919)828-9443

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Because of the nature of the subject all of the contexts are addressed in this material.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Social Science, Science

Overview

Students examine cartoons and gain additional perspectives on acid precipitation. The cartoons are used to stimulate discussion about values, science, and society.

Objectives

After completing this activity, students should be better able to:

- list the values expressed or implied.
- compare the cartoonist's values and judgments with their own values and point of view.
- describe the issues, people, or events shown.
- interpret the message or viewpoint.
- identify the frame of reference and biases of the cartoonist.
- understand that cartoons often exaggerate for emphasis.
- recognize that cartoons are much more likely to identify problems than to offer solutions.
- appreciate the editorial functions of cartoons.

Materials

Collection, Acid Rain Cartoons
Cartoon (phlun Worksheet Cards
Overhead Projector

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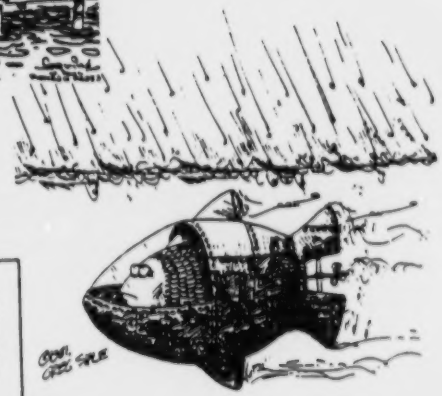

Cartoon by Peter Steiner. Reprinted from the National Wildlife, with permission.

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

ECOLogy: Environmental Career-Oriented Learning

STATED GOAL:

Infusing ecological concepts, career information, and futures understandings into basic skills subject matter.

FORMAT:

Units called Environmental Learning Experiences and supporting Project Activity Kits; there are 6 primary, 14 intermediate, and 8 secondary units. Units focus on energy, water, air, solid waste, and noise.

AVAILABILITY:

Prices vary from $200.00/grade level and up. Contact:

Genelle Bentley
N & C MN Reg. State Facilitator
HCR 3, Box 15
Staples, MN 56479
(218)894-1930

-or-

Gail Goltz
SW & WC ECSU
SW State University
Marshall, MN 56258
(507)537-1481

-or-

Diane Lassman
116 University Press Building
University of Minnesota
Minneapolis, MN 55414-3092
(612)624-0584

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH AREAS CAN IT BE INTEGRATED?

Science, Social Science, Career Education

LESSON 15

½ hour

CONCEPT: How we can produce more food.

MATERIALS: paper
pencils
overhead projector

PROCEDURE: Divide class into 5 groups. Tell them: *You have seen several films which show what will happen if we don't solve our growing food shortage. You have also seen in the films ways that we can increase food production.*

EVALUATIVE ACTIVITY: *Your group is to make a list of as many solutions to the food crisis as they can in the next 15 minutes.* When the time is up have each group read their list. Write the items on the overhead, making a master list for everyone to see.

Discuss each item as it is volunteered. Perhaps students will think of solutions that they had not previously thought of.

EXTRA ACTIVITIES: See Activity Cards.

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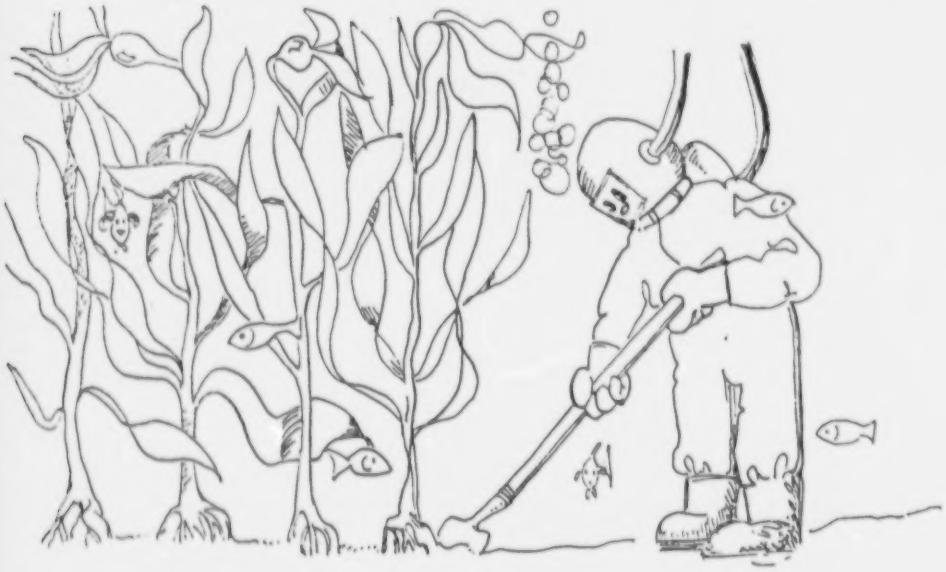


LESSON 14
(to be used after weigh in #7 (Lesson #4) on Monday)

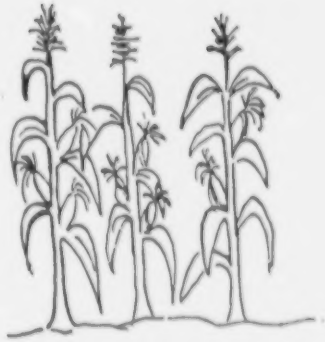
CONCEPT: Students see how critical the food shortage problem is world wide.

MATERIALS: Film: "Food or Famine" (29 min.)

PROCEDURE: Say - *We have studied future trends in food production. The film you are going to see shows what happens when we don't plan ahead (famine) and then gives us some additional ideas on how to use ecology methods to prevent mass starvation.* (Show film - 29 min.)

EVALUATIVE ACTIVITY: Ask - *What are some of the reasons for famine?* Encourage and discuss all answers. *What can be done to avoid famine?* Again, encourage and discuss all answers thoroughly. *What could you as one person in situations similar to those in the film do to avoid famine? What could a government do? Whose responsibility is food production? Why* Encourage answers and discuss each thoroughly until you feel students see that everyone must share in the responsibility and do his part through being informed and being aware of current and future situatio

EXTRA ACTIVITY: See activity cards in back.



food or famine

SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Energy Conservation Education for New York State

STATED GOAL:

Interdisciplinary learning activities for grades 7-12 in energy conservation

FORMAT:

A set of 18 activities each with objectives, skills, and knowledge needed, and suggested methods. Activity titles include: Energy Related Careers; Trading Calories for Kilowatts; Keep the Heat; and Conserving Automotive Fuel.

AVAILABILITY:

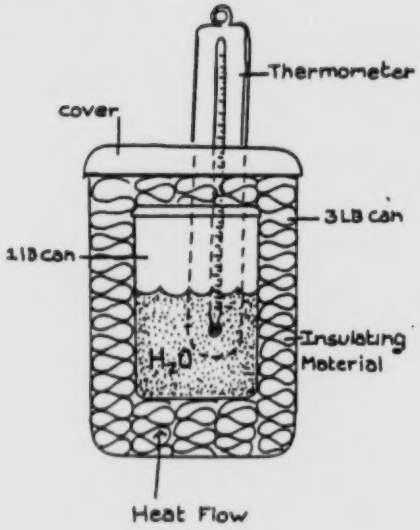
Free. Contact:
New York State Energy Office
Two Rockefeller Plaza
Albany, NY 12223
(518)474-2161

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Math, Social Science



10

METHOD

1. Assemble your insulation tester:
   a. Using a punch, place a hole in the plastic lids of the two coffee cans.
   b. Place a layer of one kind of insulation around the inside and on the bottom of the 3 lb. can in such a way that the one lb. can fits inside comfortably. (See diagram.) Other students will use different insulation materials.
   c. Place the one lb. can inside the 3 lb. can.
   d. Place 300 ml. of water at room temperature in the one lb. can.
   e. Place the plastic lids on the cans.
   f. Carefully insert the thermometer through the holes in the two lids.
2. Place the insulation tester on a ring stand.
3. Record the temperature of the water.

ACTIVITY 10

INSULATION TESTING

INTRODUCTION

Why is it that some houses have small heating needs while others of the same size use so much fuel? Insulation often makes all the difference.

In this activity you will compare the insulating ability of several different materials.

SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Energy 80

STATED GOAL:

To provide a comprehensive, academically oriented energy education program for grades 7-12.

FORMAT:

Energy 80 is a 60 page all-color booklet for each student. It exposes students to all the major energy concepts. Also available are Energy Skill Builders, a series of 12, 8, or 16 page booklets addressing specific energy concepts. Titles include: Sources of Electricity, Geology of Oil. A Teacher's Guide offers suggested lesson plans, learning outcomes, background information, tests, and a reproducible mini-quiz for each topic in the student text. The same teacher material is available for the Energy Skill Builders. Teacher training is also available.

AVAILABILITY:

Order from:
Enterprise for Education
1320 "A" Santa Monica Mall, #202
Santa Monica, CA 90401
(213)394-9864

Prices: Energy 80 Student Booklets - $1.75 each
8 Vol. Teacher Guide Set - $42.50
Energy Skill Builders vary from - $7.93 to $16.80 per classroom set of 22.

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

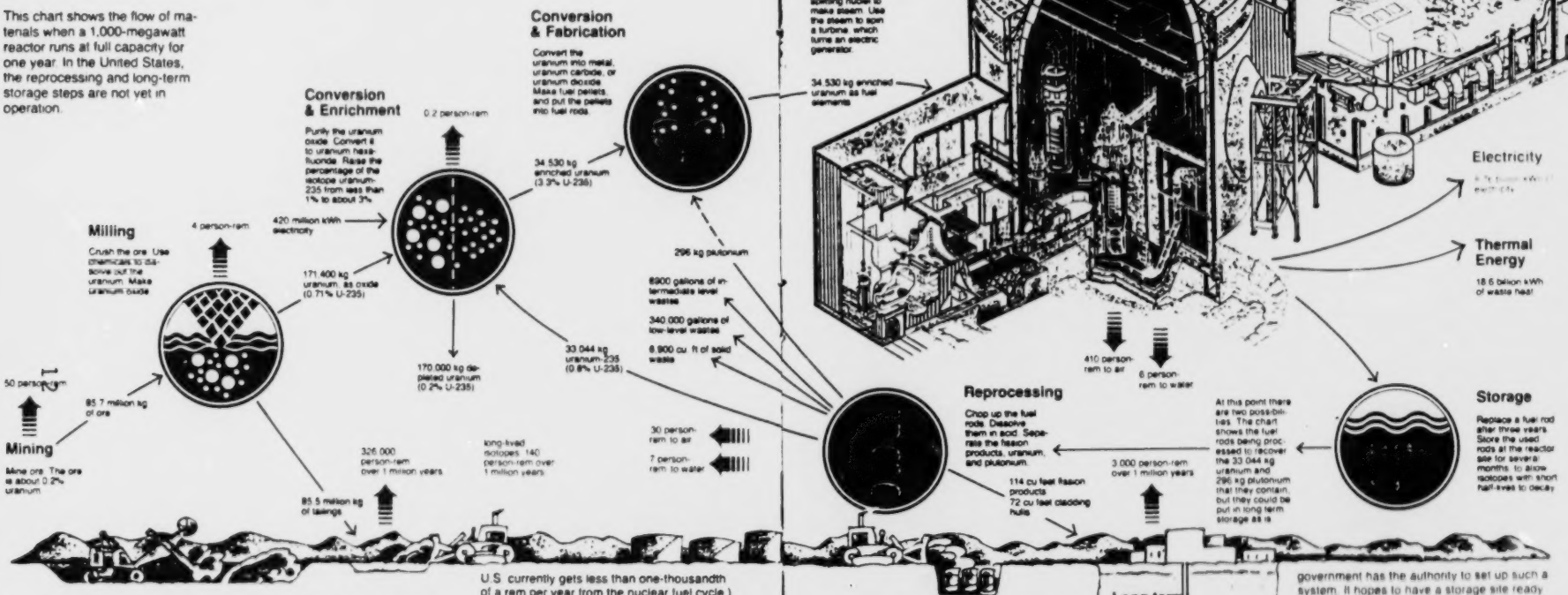
All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Social Science, Language, Economics, Math

The Nuclear Fuel Cycle

This chart shows the flow of materials when a 1,000-megawatt reactor runs at full capacity for one year. In the United States, the reprocessing and long-term storage steps are not yet in operation.


Mining
Mine ore. The ore is about 0.2% uranium.
50 person-rem
85.7 million kg of ore
Milling
Crush the ore. Use chemicals to dissolve out the uranium. Make uranium oxide.
4 person-rem
85.5 million kg of tailings
326,000 person-rem over 1 million years
Conversion & Enrichment
Purify the uranium oxide. Convert it to uranium hexafluoride. Raise the percentage of the isotope uranium-235 from less than 1% to about 3%.
420 million kWh electricity
171,400 kg uranium, as oxide (0.71% U-235)
0.2 person-rem
170,000 kg depleted uranium (0.2% U-235)
long-lived isotopes: 140 person-rem over 1 million years
Conversion & Fabrication
Convert the uranium into metal, uranium carbide, or uranium dioxide. Make fuel pellets, and put the pellets into fuel rods.
34,530 kg enriched uranium (3.3% U-235)
33,044 kg uranium-235 (0.8% U-238)
296 kg plutonium
6900 gallons of intermediate-level wastes
340,000 gallons of low-level wastes
6,900 cu. ft of solid waste
30 person-rem to air
7 person-rem to water
Reactor
Load the fuel rods into a reactor. Start a chain reaction. Use the heat from splitting nuclei to make steam. Use the steam to spin a turbine, which turns an electric generator.
34,530 kg enriched uranium as fuel elements
410 person-rem to air
6 person-rem to water
Electricity
Thermal Energy
18.6 billion kWh of waste heat
Storage
Replace a fuel rod after three years. Store the used rods at the reactor site for several months, to allow isotopes with short half-lives to decay.
Reprocessing
Chop up the fuel rods. Dissolve them in acid. Separate the fission products, uranium, and plutonium.
114 cu feet fission products
72 cu feet cladding hulls
3,000 person-rem over 1 million years
At this point there are two possibilities. The chart shows the fuel rods being processed to recover the 33,044 kg uranium and 296 kg plutonium that they contain, but they could be put in long term storage as is.
Long term Storage
Suspend the molten radioactive waste in molten glass. Let it harden, and store it indefinitely in a dry, stable rock formation.

In the nuclear fuel cycle, we take radioactive material from the earth, concentrate its decay in space and time to get heat, and return the leftovers to the earth. In the process, we make some isotopes that wouldn't have existed otherwise, and a small quantity of material escapes into the environment.

What harm can this do? The above chart provides estimates in person-rems. A rem is a measurement of radiation in terms of the harm it could do to people.

Person-rems are found by totalling the rems received by each of the persons in a group. A U.N. committee has estimated that over the years a total of 570 person-rems of harm to the people in a region would result from all the planned releases during one year's operation of a plant. Because the released isotopes disappear by decaying, the population would get 90% of the 570 in the first year and 98% of it by the end of the fifth year.

But some of the released isotopes are long-lived. In addition, the tailings and the stored wastes from one year's operation of one plant would go on releasing radioactive materials. The U.N. committee estimated that over a million years the effect on the world population of these three sources would total 3430 person-rems.

These person-rem estimates are *not* per person per year doses. (The average person in the U.S. currently gets less than one-thousandth of a rem per year from the nuclear fuel cycle.) They are also based on many guesses (how many people? are reactors improving? what accidents can occur?). But they are useful for comparing different parts of the cycle, and for comparing the fuel cycle with other sources of radiation.

Today's nuclear reactors cannot explode like an atomic bomb. The worst imaginable accident would be a "breach of containment," in which both the steel and concrete shells of an operating reactor cracked and released radioactive materials. In 1986 a Russian plant suffered the only breach of containment that has occurred in a power reactor. That reactor lacked the multiple layers the law requires of American power reactors, which have never been breached.

As the plant operates, fission products—the nuclei made when uranium nuclei split—accumulate in the fuel. Unfortunately, many of these new nuclei are good absorbers of neutrons, and thus stop the chain reaction. So a fuel rod must be replaced before all the uranium-235 nuclei in it have fissioned.

The used fuel rods can be chemically processed to recover the unused U-235 and also the plutonium produced by neutrons hitting U-238 nuclei in the fuel. Some people fear that reprocessing would enable terrorists to steal recovered plutonium to make bombs. Right now the U.S. is not reprocessing fuel rods, but simply storing them in big pools of water.

Some of the materials produced as the reactor operates remain highly radioactive for centuries. The quantity is quite small, but it must be kept out of the environment. Storage systems have been planned, like mixing materials in molten glass and storing them in salt mines. Only the government has the authority to set up such a system. It hopes to have a storage site ready by 2000.

The benefit of nuclear energy, the electricity, is familiar and taken for granted by most Americans. One of the costs, the release of radioactive materials, is mysterious and scary to many people. One way of judging nuclear energy is to compare the fuel cycles of different ways of generating electricity. Coal is fission's chief competitor. Unlike coal, nuclear fission produces no smoke, acid rain, or carbon dioxide. Fewer workers are killed in accidents. On the other hand, nuclear technology is not as forgiving as coal: a few minutes' mistakes by a plant's operators can ruin a billion-dollar reactor. Running the nuclear fuel cycle requires more foresight and minute-by-minute attention to detail than other ways of getting electricity. But we have the uranium, and we know how to get large amounts of electricity from it.

BEST COPY AVAILABLE

SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Energy/Power/Transportation Technology Course Guide for Middle/ Junior High Schools

STATED GOAL:

To provide an orientation and exploration to our industrial society.

FORMAT:

Introduction
Competency/Content/Resources
Activities
Equipment List

AVAILABILITY:

Free. To order, contact:
Jerry Balistreri
State Specialist for Technology Education
Utah State Office of Education
250 East 500 So.
Salt Lake City, Utah 84111
(801)538-7853

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Social Science, Technology Education

COURSE OUTLINE

1.00 History of Energy/Power Sources

1.10 Chemical

Fossil Fuels:

- Coal
- Oil
- Natural gas

Biofuels

- Biomass (plant matter)
- Agriculture
- Aquaculture
- Methane
- Alcohol
- Wood

1.20 Electrical

Electrostatic:

- Friction
- Lightning
- Magnetic

1.30 Light

Solar:

- Heliochemical (Photosynthesis)
- Helioelectrical (solar cells, etc.)
- Heliothermal (solar collectors)

Sample Learning Activities

1. Build a small electric motor. 2. Build a crystal radio. (inexpensive kits available for both from IASCO). 3. Use an emergency light tube as a class demonstration of chemical to light conversion.
2. Build a small working model of a wind generator.
3. Build or bring in a toy or device which demonstrates that heated fluid, such as air or water, rises.
4. Sketch a device which can convert steam into motion. Suggest how it might be built.
5. Build working models of alternative energy converters and collect data on the most efficient methods.
6. Make a list of power systems in your community, name the type of energy converter each uses, and, if you can, list the type of energy it converts.
7. With your instructor's help, build a simple model or toy demonstrating one of the types of energy converters discussed in this chapter.
8. Construct a working model of a water wheel and demonstrate it to your class.
9. Draw up a list of energy converters which depend on petroleum for their source of energy.
10. Construct a device or toy capable of converting solar radiation to heat.
11. Construct a device which can concentrate the sun's rays on a small area.
12. Build a device which can convert solar radiation to motion.
13. Build, assemble, or demonstrate a device which can convert solar radiation to electricity.
14. Build a device which uses the sun to purify water.
15. Survey your community and report on the number and types of devices which use the sun to save energy. Select one of the types and write a report on how it works. Discuss with the owner the savings experienced in energy.

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

The Energy Source Education Program

STATED GOAL:

A comprehensive, high quality energy education curriculum for K-12

FORMAT:

Consists of 7 instructional units. Each unit is self-contained, yet is also part of a carefully formulated sequential framework. The units address specific learning objectives covering a wide range of energy topics and issues. Unit titles are: Offalot, Brightland, Fossil Fuel Junction, Power Switch (all elementary units), Energy Crunch and Energy in American History (junior high units), and Energy Choices and Challenges (for senior high). Each unit may contain puppet, filmstrip/tape, teacher guide, picture set, poster, student materials and "badges."

AVAILABILITY:

Contact:
The Energy Source Educational Council
Program Distribution Office
5505 E. Carson St. Suite 250
Lakewood, CA 90713-3093
(213)420-6814
Prices vary with each unit -- about $60 for the kindergarten unit and $150 for the secondary unit.*
*NOTE: This material is also available free from Northern States Power Co (NSP). If you are in the NSP service area contact:
Richard Stanford
Community Information
Northern States Power Company
414 Nicollet Mall
Minneapolis, MN 55401
(612)330-6042

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Social Science

Program Materials

Each unit contains all materials needed to conduct instruction. There are no exercises to reproduce, and minimal preparation time is required.

OFFALOT
(Kindergarten)
- Teacher guide
- Offalot hand puppet
- Offalot cassette
- Story picture cards
- Set of 20 energy user picture cards
- Class poster, "Energy Conservation and Safety"
- Class record sheet
  35 copies of the following:
  - Student booklet
  - Home activity booklet
  - "I'm an Offalot" badge

BRIGHTLAND
(Grade 1 or 2)
- Teacher guide
- "Brightland" filmstrip and cassette tape
- Story picture cards
- Set of 20 energy user picture cards
- Class poster, "How Energy Gets to Us"
- Class poster, "How Energy Users Operate"
- Class record sheet
- 35 copies of the following:
  - Pretest and posttest
  - Student booklet
  - Home activity booklet
  - "Energy Wizard" badge

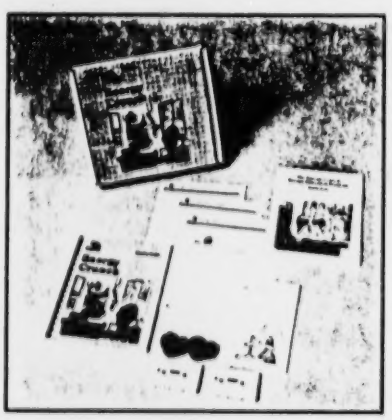
FOSSIL FUEL JUNCTION
(Grade 3 or 4)
- Teacher guide
- "Showdown at Fossil Fuel Junction" filmstrip and cassette tape
- Class poster, "How We Get and Use Fossil Fuels"
- Class record sheet
- 35 copies of the following:
  - Pretest and posttest
  - Student booklet
  - Home activity booklet
  - "Energy Saver Gang" badge

POWER SWITCH
(Grade 5 or 6)
- Teacher guide
- "Power Switch" filmstrip and cassette tape
- Class poster, "Energy Time Line"
- Class record sheet
- 35 copies of the following:
  - Pretest and posttest
  - Student booklet
  - Interview form
  - Home activity booklet
  - "Let's Have a Bright Energy Future" badge

THE ENERGY CRUNCH
(Junior high)
- Teacher guide
- Two filmstrips and cassette tapes: "The Energy Crunch Case . . . Part I" and "The Energy Crunch Case . . . Part II"
- Set of class demonstration cards
- Class poster, "Present and Future Energy Sources"
- Class record sheet
- 35 copies of the following:
  - Pretest and posttest
  - Student book
  - Conservation checklist and improvement plan
  - Home information leaflet

ENERGY IN AMERICAN HISTORY
(Junior high)
- Teacher guide
- Three filmstrips and cassette tapes: "A Country Built on Energy," "The Great Discoveries," and "People . . . Then and Now"
- Class poster, "Energy in American History"
- Class record sheet
- 35 copies of the following:
  - Pretest and posttest
  - Student book
  - Home information leaflet

ENERGY CHOICES AND CHALLENGES
(High School)
- Teacher guide
- Two filmstrips and cassette tapes: "Countdown on Energy Fuels" and "No Easy Answers"
- Class poster, "Reaching for Energy"
- Class record sheet
- 35 copies of the following:
  - Pretest and posttest
  - Student book



"As a teacher, I really appreciated the well-organized format. It took very little effort on my part to present each lesson. All the materials I needed were right at my fingertips."

Kindergarten Teacher, Anchorage, Alaska

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Energy, Technology, and Society

STATED GOAL:

To provide teaching materials emphasizing renewable energy resources, for students in grades 9-12.

FORMAT:

Five units: Introduction; Solar Energy; Biomass Energy; Wind, Water and Geothermal Energy; and Energy and the Future. Each kit includes teacher's resource book with lesson plans, 45-minute video to introduce units, computer software package, posters, and an energy file.

AVAILABILITY:

Available from:
Bullfrog Films
Oley, PA 19547
1-800-543-FROG

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Math, Social Science,

Announcing a new approach to Energy Education for grades 9-12

A COMPLETE ENERGY EDUCATION KIT

☆ Energy Technology And Society

This unique energy program emphasizes renewable energy resources and consists of five units:

Introduction to energy
Students investigate the sources, uses, and history of energy.

Solar Energy
A comprehensive study of the direct use of the sun's energy.

Biomass Energy
Students explore the use of plant and animal matter to produce energy.

Wind, Water and Geothermal Energy
Students examine the indirect uses of the sun's energy and the earth's heat.

Energy and the Future
Encourages students to question the future uses of energy.

Each kit includes:

- Teacher's resource book with
  background notes
  lesson plans
  worksheets
  detailed model plans
- Video -45 minutes introducing units
- Computer Software package
- Posters
- Energy File - containing up to date information on energy sources.

Available at the low price of $99.95
Due to the sponsorship of:
The National Energy Foundation
U. S. Export Council for Renewable Energy
Bullfrog Films
Victorian Solar Energy Council

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CONSERVATION

☆ **ENERGY EFFICIENCY**
Grades 7 to Adult 22 minutes
Produced by: Public Policy Productions for WNET/Narrated by Meryl Streep
SALE: Video only $195 RENTAL: $45
Survey of latest improvements in energy efficiency including: auto fuel efficiency, appliances, buildings-new housing designs, weatherization, home energy conservation, and breakthroughs in commercial lighting, heating, cooling and ventilation.

RECYCLING: WASTE INTO WEALTH
Grades 5 to Adult 29 minutes
Produced by: Pathway Productions
SALE: 16mm $550, Video $175 RENTAL: $50
Recycling has become a top priority for thousands of local communities. This documentary shows recycling techniques including curbside pick-up service, drop-off recycling centers, material separation, and shows how recycled materials are processed into new products.

☆ **ECOLOGY WORKSHOP SERIES**
Grades 9 to Adult Each 29 minutes
Produced by: Hans-Ernst Weitzel
Six Videos - series $900, Each $195 RENTAL $50
The following titles are from a series of six inspiring programs from Germany showing some of the latest European experiments in using natural resources efficiently and reducing our burden on the environment.

☆ **NATURAL WASTE WATER TREATMENT**
Grades 9 to Adult 29 minutes
Produced by: Hans-Ernst Weitzel
SALE: Video only $195 RENTAL: $50
Small decentralized sewage treatment plants, that use the natural purifying characteristics of marsh plants, are operating successfully in Germany, Switzerland, and the Netherlands.
(Ecology Workshop Series)

☆ **FLUSH TOILET, GOOD-BYE**
Grades 9 to Adult 29 minutes
Produced by: Hans-Ernst Weitzel
SALE: Video only $195 RENTAL: $50
For his home near Lake Geneva in Switzerland, physicist Pierre Lehmann has designed a composting toilet. He dumps his wastewater into a pond where waterplants and billions of microbes remove impurities.
(Ecology Workshop Series)

☆ *New* ● *Bestseller*

SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Environment and Technology Project
Chicago, IL

STATED GOAL:

An interdisciplinary curriculum which enables students to understand the impact of science and technology on the environment and actively engages them in a problem-solving approach, as citizens able to make decisions based on sound technological choices.

FORMAT:

Sixteen units in 4 categories: energy, land use, pollution, urban management; worksheets; teacher's handbook.

AVAILABILITY:

Two days training required before ordering materials. Average cost per set $130. Additional student units available at $4.25 each. Contact:

Genelle Bentley
N & C MN Reg. State Facilitator
HCR 3, Box 15
Staples, MN 56479
(218)894-1930

-or- Gail Goltz
SW & WC ECSU
SW State University
Marshall, MN 56258
(507)537-1481

-or- Diane Lassman
116 University Press Building
2037 University Ave. SE
Minneapolis, MN 55414-3092
(612)624-0584

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH AREAS CAN IT BE INTEGRATED?

Science, Social Science

FOR HIGH SCHOOL SCIENCE
AND SOCIAL STUDIES TEACHERS

A CURRICULUM
ACTIVELY INVOLVING STUDENTS
IN THE STUDY OF

SCIENCE, TECHNOLOGY,

AND THE

ENVIRONMENT

20

Concern Regarding
THE ENVIRONMENT AND TECHNOLOGY
In Our Nation/Neighborhood

An Exemplary Educational Program
National Diffusion Network
U.S. Department of Education

THE ENVIRONMENT AND TECHNOLOGY PROJECT

This high school curriculum project is organized around societal issues that arise from rapid change in science and technology. It enables students to become informed citizens able to apply science and social science knowledge to resolving science-related social issues.

The project was initially developed by classroom science and social science teachers in LaSalle-Peru, Illinois who were concerned with increasing dangers to the environment that arise from advances in science and the use of science technology.

High school teachers in over 22 states and the District of Columbia are currently using this exemplary project in their high school courses. The curriculum is used in grades 9-12, with students of all ability levels in courses such as Biology, Ecology, Social Problems, and Science and Society.

OBJECTIVES

The curriculum is intended to teach three sets of objectives:

UNIVERSAL objectives - Interdependence, Impact, Maintenance, Quality of Life, Improvement - run like threads throughout the curriculum.

CATEGORY objectives are stated for the board topics of Energy, Land Use, Urban Management and Pollution.

UNIT Objectives are stated for each of the 16 individual curriculum titles.

CURRICULUM

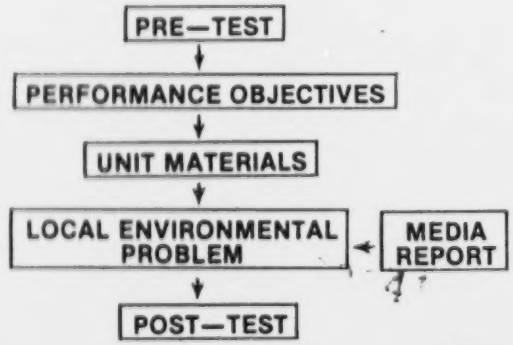
A student studies a minimum of one unit in each of these four categories in a semester:

Energy	**Land Use**
gasoline	urbanization and
electricity	zoning
nuclear power	streets and roads
coal	parks and recreation
solar	wildlife

Urban Management	**Pollution**
solid waste	air
waste water	water
population	noise
	rural

COURSE DESIGN

Students choose a unit, take a pre-test and move through units materials which are written to specific learner outcome objectives. The study of **local** environmental problems allows students to use their knowledge to integrate the classroom with the community. The post test helps the instructor and student evaluate growth.



SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

EXPLORING ENERGY: Sources/Applications/Alternatives

STATED GOAL:

To raise student literacy with respect to energy sources, usage of energy, alternatives, and social impacts.

FORMAT:

13 chapters covering in order: nature and historical aspects of energy; power and measurement systems, conversion and converters; fossil fuel systems; systems of alternate energy; why and how of energy conservation; careers in energy field.

AVAILABILITY:

EXPLORING ENERGY, 304 pp. List Price: $18.64 Order from:
The Goodheart-Wilcox Pub. Co., Inc.
123 West Taft Drive
South Holland, IL 60473
(312)333-7200
(WATS 1-800-323-0440)

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED:

Language, Science, Math, Technology Education, Industrial Arts

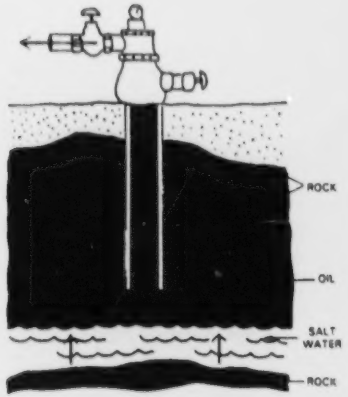


Fig. 6-11. Sketch of water drive. Salt water occurring naturally drives oil into well, up the pipe to the surface.

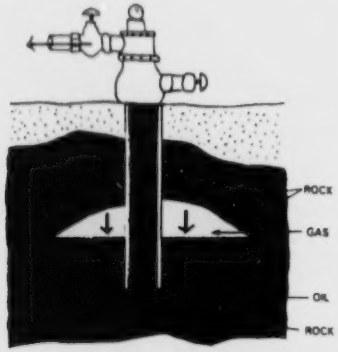


Fig. 6-12. Gas-cap drive. Trapped underground, natural gas in dome exerts pressure on oil to drive it to surface.

tremendous pressure, drive the oil up the tubing. See Fig. 6-12.

3. Dissolved gas drive. There is no gas cap in this type of drive. The gas is dissolved in the oil, Fig. 6-13. The low pressure in the well casing causes the trapped gas to move into the well, dragging oil with it. It is not as efficient as the water or gas-cap drive. Some of the oil gets left behind.

ARTIFICIAL DRIVE

As wells give up their oil, natural pressure drops and eventually the flow stops. Then the remaining oil must be brought up by some other means. One of several artificial methods is used:

1. Pumping. This is the most common. Some wells never flow naturally and must be pumped from the start, Fig. 6-14.
2. Gas-cycling. This method uses gas previously removed from the well to maintain the pressure. The mixture of oil and gas is separated as it comes from the well. The oil goes to storage; later it will be transported to a refinery. The gas goes to a natural gas processing plant. Being a mixture of other

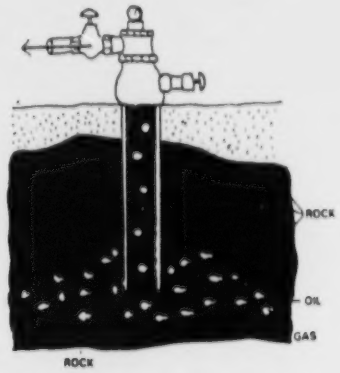


Fig. 6-13. Dissolved gas drive. Trapped gas mixes with oil dragging mixture into well and to surface.

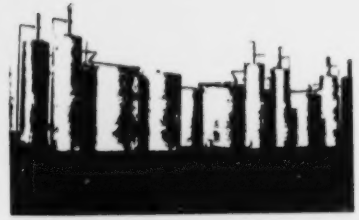


Fig. 6-14. Pumping with a lift pump is the most common method of bringing oil to surface. Top. This rocking beam pump is a familiar sight in oil fields. Bottom. Pumped petroleum is stored temporarily in tanks nearby.

petroleum products such as propane, it is known as WET GAS. These by-products are removed and some of the gas is returned to the oil pool by way of an INPUT WELL, Fig. 6-15. It helps maintain the pressure and keeps the oil moving into the well.

3. Repressuring. In this method the oil reservoir is flooded with water or injected with more gas to raise the pressure.

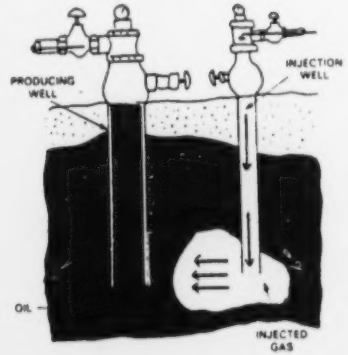


Fig. 6-15. Artificial drive. Gas pumped into an injection well may be used to force oil to the surface.

4. Front burning. This method is used in wells that contain heavy oil. A fire is lighted in the reservoir while air is pumped into it. The pressure of hot expanding gases and the heat make the oil flow better. Another name for this method is "in situ combustion." (In situ means "in place" or "on location.")
5. Steam injection. Steam is generated at the wellhead and fed down the well into the oil-bearing rock. Steam causes the oil to expand and move toward the well. Some of the lighter oils vaporize and these gases provide additional pressure to move the oil.
6. Other methods being considered for oil recovery are: high pressure gases, nuclear explosives, and solar and electrical heat.

INCREASING OIL FLOW

Low pressure and loss of pressure are not the only problems faced in extracting oil. Sometimes low porosity (too dense) of the rock formation keeps oil from the well. Then the porosity of the rock must be improved by:

1. Fracturing treatment.
2. Acid treatment.

22

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

IDEAS Iowa Developed Energy Activities Sampler

STATED GOAL:

To provide energy education activities for elementary and secondary schools.

FORMAT:

An elementary packet and a secondary packet are available. Each contains teacher resource material and student activities with goals and objectives.

AVAILABILITY:

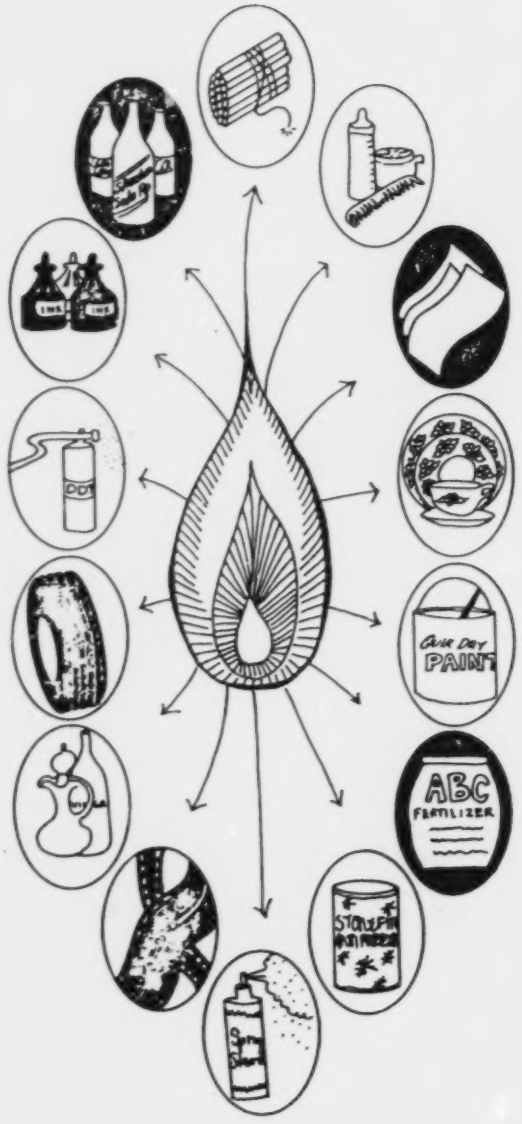
Cost: approximately $12. Order from:
Duane Toomsen, Dept. of Education
Grimes Building
Capitol Complex
Des Moines, IA 50319

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Math, Social Science



TITLE Operation Pipeline!

SUBJECT Science, Art, Creative Dramatics **LEVEL** Intermediate

ACTIVITY IN BRIEF

Students will act out the sequence of events dealing with natural gas(from drilling site to the home.)

OBJECTIVE

Each student will describe the sequence of events from natural gas production to the delivery to the power plant and to the home. The student will be able to explain where and how their community gets its natural gas.

MATERIALS

handouts 10a
10b (optional)

TIME

Awareness - 30 minutes
Concept development - 15 to 30 minutes
Application - One session - variable

LEARNING CYCLE

AWARENESS - The students "become" the various components of the natural gas distributing system. Two children form the drilling rig, four or five more join hands to become the pipe line, carrying natural gas to the power plant. Four children become the trees in the forest which need to be chopped down so the pipeline can go through. The three children forming the power plant make electricity using the natural gas as fuel. Four more children become electric lines "zapping" electrical current to the house (2 or more children). One child becomes the radio in the house, another becomes the pot of water. Two students move about to show energy loss due to heat and friction. The teacher directs the floor plan. The students pose as the various components. They also create the sound effects. The teacher will establish the order of events from drill site to the teakettle. When the pot of water boils and the radio broadcasts a weather report, the chain of events has been completed.

1. Drilling rig	2 students	hold hands and pump up and down - making pumping sucking sounds
2. Pipe line	4-5 students	connect hands - "swish swish" sound
3. Trees	4 students	outstretch and connect arms (fall when "chopped down" for the pipelines to come through)
4. Power plant	3-5 students	make electricity (turbines could spin around)
5. Electric wires	4 students	connect hands and "zap-zap" electrical current

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Managing Our Natural Resources

STATED GOAL:

To provide comprehensive, up-to-date coverage of every facet of natural resource management including: soils, water, game, and energy. The text presents the background of various conservation issues and relates them to the present day. A short history of natural resource management is also included.

FORMAT:

300 pp., 8x9-1/9, hardcover, 1988. Contains 31 chapters and a glossary of key terms. Each chapter includes: performance objectives, "Terms-To-Look-For", summary, review questions, and suggested activities, plus a careers section giving students an in-depth look at a wide range of possibilities. Sensitive issues (ie., nuclear power) are handled objectively, and student activities deal with issues in students' communities.

AVAILABILITY:

For additional information and/or to place an order, contact:
Customer Service Department
Delmar Publishers, Inc.
Two Computer Drive West
Box 15015
Albany, NY 12212
1-800-347-7707
Fax: 518-459-3552

Note: All prices are tentative and subject to change without notice.

Text	Order #2756-0	$20.95 List/$18.00 Net
Instructor's Guide	Order #2757-9	$ 8.00 List/$ 6.00 Net

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Social Science, Agriculture, and Forestry

the tractor turns less often and the equipment can cover the field more quickly. However, not all farmers have large, level fields with no danger of erosion. Whenever there is even a gentle slope, the rows should be run generally across the slope to control the speed of the runoff.

As the slope gets steeper, this becomes even more important. Moreover, as the slope becomes irregular, it is necessary to go to contour plowing instead of plowing in straight rows.

The contour rows are not laid out exactly straight across the slope. They should run downhill very slightly. This allows the runoff to be conducted in the desired direction. In addition, the rows cannot handle too much runoff at a time, so they should empty at fairly regular intervals into pastures, tree lines, or grassed waterways (see figure 6-7, page 55).

Terraces

Contour plowing can control only so much runoff at a given time. Once the rainfall or snowmelt is more rapid than the rows can handle, water spills over the top rows on the hill. Each lower row then has not only its own excess water but that of all the rows above it. You can see clearly that this situation can become very destructive in a hurry.

Terraces are larger surface channels constructed on the contour with a controlled rate of fall. They are designed to accept the runoff and conduct it across the slope to some protected area. Terraces are needed on fields whenever the slope exceeds about 2 percent and where the slope is over a few hundred feet long.

Originally, terracing developed in the Far East where dense populations required the use of all available land for food production. Even very steep hillsides could be farmed using terracing techniques (see figure 6-11a and b).

In this country, such extreme methods have not been necessary. To American farmers, a terrace might look more like figure 6-11b.

Terraces such as the one shown can be constructed using the conventional moldboard plow or with other earth-moving equipment. The size, length, slope, and distance between terraces are all important considerations and the terracing system should be designed specifically for each field. Assistance in designing and constructing terraces is available from the Soil Conservation Service, since attempting such an undertaking should not be done without seeking such help.

CONTROLLING WIND-CAUSED EROSION

Windbreaks

We usually think of a *windbreak* as a row of trees and/or shrubs planted across the prevailing wind direction. It serves to disrupt the surface movement of the wind. Windbreaks are normally planted to shelter the farm buildings and residences from high winds.

Windbreaks reduce the cost of heating the home during winter and the cost of cooling the home during summer. The shade provided by the trees is cool and pleasant, and the evaporation of water through the leaves has an additional cooling effect. Windbreaks also help keep the soil moisture from evaporating as rapidly as it ordinarily would.

Shelterbelts

Shelterbelts are similar to windbreaks but are planted to provide protection for crops and livestock. Shelterbelts, like windbreaks, may consist of trees, trees combined with shrubs, or just shrubs. Both the height and density of the shelterbelt determine its effectiveness.

The surface speed of the wind is affected for

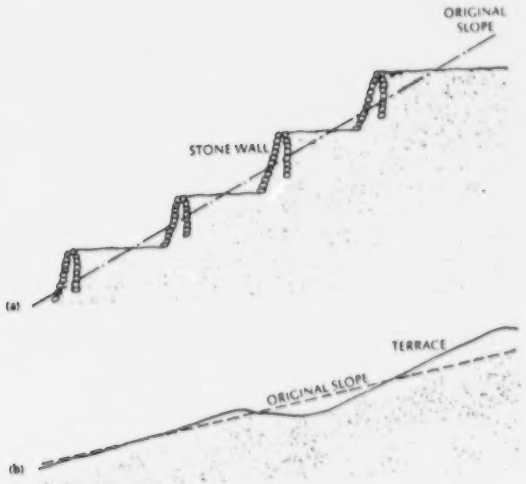

FIGURE 6-11
Terracing extremes: (a) steep slope, (b) gentle slope

great distances from the shelterbelt. Some protection is offered downwind at least twenty times the height of the shelterbelt (see figure 6-12).

Conservation Tillage

Just as in controlling water-caused erosion, conservation tillage techniques are valuable in controlling wind-caused erosion. Crop residue left on the field helps conserve soil moisture, reduces surface windspeed, and holds loose soil particles in place.

There is one exception, however, where wind erosion is not a serious concern and soil moisture is critical. Dry land farmers sometimes cultivate the surface of a field into a loose, sandy layer. This has been done to conserve soil moisture better than surface litter. This practice should be reserved for areas with low wind-erosion danger.

Contour Farming

In a very real sense, it is possible to row crop on the contour for wind much like for water. The rows are plowed across the prevailing winds. Each row of the crop then acts like a miniature

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

National Energy Education Development Project

STATED GOAL:

To provide a variety of energy education materials to elementary and secondary teachers and students.

FORMAT:

A packet containing several booklets and leaflets. Titles include: The Energy Mystery Files (plays); 1989 NEED Energy Education Poll; The Energy Carousel (a display to make); NEED Energy Activities; NEED Resources (NEED = National Energy Education Development); and the magazine, "Energy Exchange".

AVAILABILITY:

Cost: $25. Order from:
NEED Headquarters
PO Box 2518
Reston, VA 22090
(703)860-5029

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Arts, Science, Math, Social Science

Using The Media

Background

This activity is not so much an activity in itself as much as it is a method to help you publicize other NEED activities and programs in your school and community. For instance, you might want to consult this activity to publicize a NEED Carnival or NEEDay program. As you probably know, the best way to reach a large audience is by using the general media – radio, television, and newspapers. Just remember, you'll need to plan ahead to use the media, especially if you want to use radio and television stations to spread your NEED message.

How to Organize

STEP 1 Before you do anything, you must be clear on a few questions. Exactly what information about NEED and/or energy do you want to get out to the public? Should this information be aimed at a specific audience or the public in general? What resources do you have in the community to help you reach your goals? Would one resource be better than another?

Once you have answered these questions, set some definite goals and realistic plans as to how you can accomplish them. If you choose to use the media to reach your goals, you will be more successful if you approach them with a definite plan of action.

STEP 2 Do some research about the newspapers and radio and television stations you would like to use. Who would be the best person for you to contact? Are there deadlines that you will have to meet? What audience will you be reaching and what is the size of that audience? (Specific tips for each medium – radio, newspapers, and television – are given below.)

STEP 3 Approach the appropriate person with your plan. You can do this in person, over the telephone, or by letter. Whichever method you choose, be professional and be well prepared!

STEP 4 After your program, send out thank you letters to everyone who helped you reach your goals.

Radio

Research the radio stations in your community and the types of programming they air. This will give you an idea about the audience they reach. Some stations will probably stand out as more logical to approach than others. Next, talk to the program director about your goals, expressing how the radio station can help. Some activities that would be successful on the radio are given below.

- *Have the DJs give out energy tips, facts, and trivia during NEEDay. You should prepare the list for them, making sure that you've given them enough information to last the day. (This activity would be similar to the campaign for "The Great American Smoke-Out," where people were strongly encouraged to stop smoking by hearing all sorts of startling facts.)*
- *Request the DJs to play energy-related songs during the day such as "Here Comes the Sun," or "Good Morning Sunshine." Again, you prepare a list of the songs that fit into this category.*
- *Have the radio station run an energy contest on NEEDay. For example, a DJ could give a prize to the third caller who answers an energy-related question. You will need to work with local merchants ahead of time to obtain prizes for the contest. Appropriate prizes include free tune-ups, or free albums, dinners, etc.*

Newspapers

Depending on your goals, newspapers may be the best and easiest medium to use. Several suggestions for using this medium are given below.

- *Prepare a news release for the local papers that briefly explains NEED and any activities you've planned. Direct this release to the appropriate person and make sure that it is in on time.*
- *Invite appropriate reporters (those covering education or energy) to attend and/or participate in your NEED celebration. This can be done with a letter and then a follow-up telephone call (or vice versa).*
- *Work with a reporter to prepare a feature story on "What's Happening With Energy Today." This may be tied in with an Energy Expo, an outstanding energy project, or energy research being done in the community.*

Television

Television may be the hardest medium to enlist in helping you, but it can be the most rewarding. Just one story on the evening news can reach an audience of 100,000 or more. A couple of suggestions for working with this medium are given below.

- *Invite reporters to attend and/or participate in special NEED events. The more you can involve a reporter in your program (as a panelist, for example), the more likely it is you will get television coverage. Make sure you give the invitation in plenty of time, and that you follow up with a letter outlining all the details.*
- *Contact your local "Evening Magazine" show about broadcasting a show live from your NEED celebration. The show's hosts could highlight some of your energy activities between regular story segments. Alternatively, contact a local morning or weekend television show about doing a segment on your NEED activities.*

The Let's Talk Energy Show

Goal: To produce a television-style talk show on a current energy issue.

Background

The Let's Talk Energy Show is a spin-off of popular television shows such as the *Oprah Winfrey Show* or the *Phil Donahue Show*. A student assumes the role of a TV talk show host. Once an energy issue has been selected, experts on that subject (either professionals from the community or students) will appear with the talk show host to fully examine the issue. Audience members will also have the opportunity to participate by asking questions of the guests and sharing their comments.

How to Organize

STEP 1 Decide how you want to use The Let's Talk Energy Show activity. For instance, several students can present the show to the rest of their class, or they can present the show to the entire student body or a particular grade level. Or, going one step further, students can present the show during the evening for both students and the community. In this instance, teachers could give extra credit to students who attend the program. Once you've made your decision, select and get permission for a location and date for your show.

STEP 2 Select an energy issue for your show. If you have a copy of the NEED '89 Energy Education Poll, you may want to refer to the opinion questions for ideas. You can also speak with teachers, energy experts, and elected officials for more ideas on energy issues of local and regional concern. Once you've made a list of energy issues, narrow down the field to two or three. Then look at the resources you have available before making the final decision (i.e., energy experts' availability, publications, etc.).

Alternatively, you can choose to do the foam polystyrene issue that's highlighted in the sample show given with this activity. If you do choose to do this issue, then contact Dow Chemical for energy experts who may be able to appear as guests on your show in your area. Just call or write:

Mr. Karl Kamena, Director of Government Affairs
Plastics Group, Dow Chemical
2040 W. H. Dow Center
Midland, Michigan 48674
(517)636-1408

You will then also need to contact experts on the other side of this issue. Contact environmental groups or city or town officials in your area.

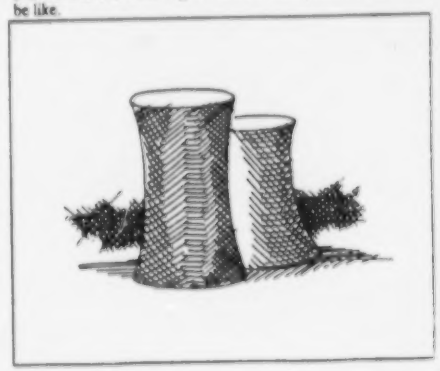
STEP 3 For this activity, it is best to use energy experts for your show's guests if at all possible. It would be difficult for students to become quick experts in a field such that they could answer questions from an audience knowledgebly. If you will be using energy experts, contact them early with a phone call and be prepared to give them all the important information on the telephone such as time, location, topic, size and grade level of audience, and show format. If the experts say yes, follow up with a thank-you letter confirming the same points. Let the experts know that you will be mailing them a written script for the show (Step 5) one to two weeks prior to the show. This will give them an opportunity to prepare for your show.

STEP 4 Find out everything there is to know about your energy issue. Talk to energy experts to determine all views on the issue. Call your local congressional offices to see what information they can give you (see NEED's Resource guide). Send away for publications. Your host will have to know the subject *very well* in order to react to comments, ask and answer questions, and keep the show moving.

STEP 5 Develop a script for the host to follow. Feel free to use or copy the format of the sample show given with this activity. The show can vary in time from 30 minutes to an hour, depending on your circumstances. Break the time period into three segments. Segment One is used to introduce the guests and the energy issue. In this segment, background information is provided for the audience and preliminary questions are asked. Segment Two is used for questioning and comments by the host and the audience. Segment Three is used for final comments and a wrap-up. This last segment is usually very short.

Your script will have the host asking a great number of questions, delving deep into the issue you have selected. The questions presented during Segment One of the show will help provide the necessary background on the issue for the audience, such as the who, what, where, how, and why. During Segment Two, the host will move through the audience,ing audience members to ask the guest questions. The host will also make statements looking for audience reaction. The host can move the questions in the right direction, making sure that all sides of the issue are examined and expanding into areas that the audience may not think of.

NOTE: When choosing a host, look for someone who will be at ease in this situation, someone outgoing. Also make sure your host watches the *Oprah Winfrey Show* or the *Phil Donahue Show* one or two times to get an idea of what your show should be like.



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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Oscar's Options

STATED GOAL:

Written for grades 4-8. These two books present activities to educate students on solid waste management.

FORMAT:

Activities with listed objectives integrated into math, reading, creative writing, and art. Teacher pages with background information included.

AVAILABILITY:

Prepared by Rhode Island Department of Education. Available free from:

Waste Education Coalition Clearinghouse
Minnesota Waste Management Board
Sue Thomas, Waste Education Planner
1350 Energy Lane
St. Paul, MN 55108
(612)649-5483

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Social Science

THE CHOICE IS *CLEAR*

Your parents and grandparents may well remember when milk and soda came in glass bottles. The empty bottles were returned to the store. When the store collected enough bottles, they were trucked back to the bottling company. Sterilization guaranteed there would be no germs left on the bottles. Then each bottle was refilled and sent back to the store. Some bottles made this trip as many as 20 times. When the bottle broke or became too badly scratched, the glass was melted down and reformed.

In the 1970s, things began to change. Milk started appearing on grocery store shelves in wax cartons and plastic jugs. The soda industry switched to plastic containers. Businesses made this choice based on cost. They found it cheaper to make millions of plastic bottles than to reuse glass ones. Perhaps, for the manufacturer, it does cost less. But what about us? We pay for this through energy and water consumed. Air pollution and increased solid wastes are also part of our cost.

STUDY THE CHART BELOW.
USE THE INFORMATION TO CREATE SIX BAR GRAPHS.

CONTAINER COSTS FOR 1000 GALLONS OF SODA

Times used	GLASS 19x	GLASS 1x	ALUMINUM 1x	PLASTIC 1x	STEEL 1x
Energy (10^6 BTU)	15.90	64.38	75.61	63.33	38.83
Water (1000 gal)	11.35	38.94	15.17	41.71	39.01
Industrial Solid Waste (cu.ft.)	6.59	38.46	36.13	7.21	108.00
Atmospheric Emissions (lbs.)	70.52	261.01	323.02	240.07	145.08
Waterborne Wastes (lbs.)	27.43	56.46	69.00	68.79	18.14
Post Consumer Solid Waste (cu.ft.)	7.16	40.97	2.07	27.05	3.49

NAME_____

CODED RECYCLABLES

All of these things can be recycled. They are in code, which means that one letter stands for another. Can you solve the code?

1. ZBEVNJNBP
2. OWJVV
3. IDADP DTW
4. ATPBV
5. JWYITZYI LJZV
6. LJPFRDJPF
7. JVNCJWA
8. IBAJW
9. WBJSBV
10. LJPV

SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

POWER TECHNOLOGY, 4th edition

STATED GOAL:

To introduce the major concepts underlying each of the traditional and alternative sources of energy including: 1) the ways in which each concept has been developed; 2) the major conversion systems which provide usable power; and 3) problems to be solved to increase usefulness and efficiency.

FORMAT:

Hardcover, 516 pp., 8x9 1/8. Consists of 33 units (with objectives, italicized key terms, and review questions) conveniently organized into 9 sections, plus 4 appendices and a glossary. Presents an overview of energy sources/applications, environmental effects, and future considerations. Separate units are included for major alternative energy sources.

AVAILABILITY:

For information and/or to place an order, contact:

Customer Service Department
Delmar Publishers, Inc.
Two Computer Drive West
Box 15015
Albany, New York 12212
1-800-347-7707
Fax: 518-459-3552

Prices: All prices are tentative and subject to change without notice.

Text	Order #2446-4	$24.95 List $18.71 Net
Study Guide	Order #2424-3	$ 8.95 List/$ 6.71 Net
Instructor's Guide	Order #2447-2	$ 7.00 List/$ 5.25 Net

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Natural and Social

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Social Science, Secondary level power technology and power mechanics courses, technology education curricula

damper is used to close the flue and stop the loss of heat. Flue dampers are often used on furnaces and water heaters.

Figure 14-23 shows the operation of a typical flue damper. When there is no heat from the appliance in the flue, the damper closes and reduces heat losses. When the appliance turns on, the exhaust heat from the appliance heats a bimetallic coil. As the bimetallic coil expands, it causes the vent to open, allowing exhaust gases to escape. When the appliance shuts off, the temperature is removed from the bimetallic coil. This causes the vent to close again, preventing or reducing heat losses.

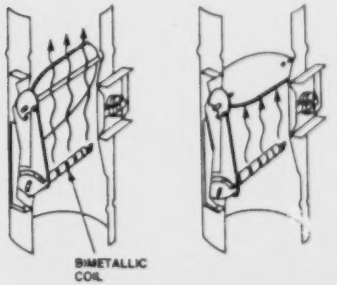

FIGURE 14-23 This flue damper automatically closes the flue vent during the off cycle, preventing wasted energy. *Courtesy of Hy-Temp Manufacturing, Inc.*

Air-to-air Heat Exchangers

As homes are designed to reduce infiltration, they become much tighter. This causes fewer air changes per hour to occur. Lack of fresh air can cause health problems. Whenever cold fresh air is allowed to come into a dwelling, the result is wasted energy and higher energy costs. To offset this problem, air-to-air heat exchangers are being used. Although mostly used in commercial buildings to reduce heat losses, more homes are using them each year.

Figure 14-24 shows how heat loss is reduced while fresh air is entering the building. Air at a temperature of 72°F enters the heat exchanger and is exhausted. Fresh air from outside at 20°F is heated by the heat exchanger before it comes into the home. The air now entering the home is 60°F rather than 20°F. Notice that there is very little heat loss, while still allowing fresh air to enter the building.

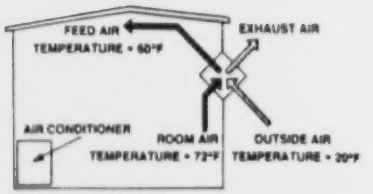

FIGURE 14-24 Air-to-air heat exchangers are used to bring in fresh air without losing thermal energy in the process.

Dryer Vents

Most homes today have a clothes dryer. Normally, the dryer uses either electrical energy or natural gas. The exhaust of this appliance can become a very good heat source for most homes. Typically, when the dryer is in operation, the exhaust is sent outside and wasted. The exhaust usually has two major properties: moisture and thermal energy.

A dryer vent is used to redirect the dryer exhaust back into the building, Figure 14-25. Both the recaptured thermal energy and the moisture are excellent for improving energy efficiency in a home.

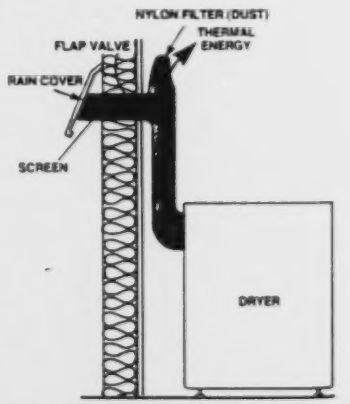

FIGURE 14-25 This dryer vent is used to redirect thermal energy from the dryer back into the room.

Insulating the Water Heater and Pipes

Normally, it pays to insulate the water heater and pipes in any home or building that uses hot water. Typical paybacks are from one to three years. Make sure to wrap all hot-water pipes with insulation. In addition, both electric and natural gas water heaters should be insulated if the heater feels warm to the touch. Figure 14-26 shows both types of water heaters and a hot-water pipe wrapped in an insulation blanket.

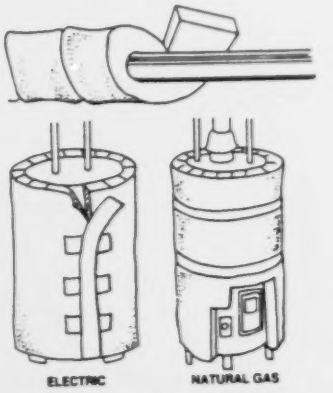

FIGURE 14-26 Hot-water pipes and the hot-water heater should be adequately wrapped in insulation.

Air-lock Entry

An air-lock entry is another technique for saving energy in both commercial buildings and residential homes. Its purpose is to keep out cold air in the winter when the doors are opened. The air lock uses two doors for people to pass through. By using two doors, infiltration is reduced; thus, heat loss can be reduced significantly. In addition, different types of outside doors have different R values, as shown in Figure 14-27. An external door should always have insulation inside.

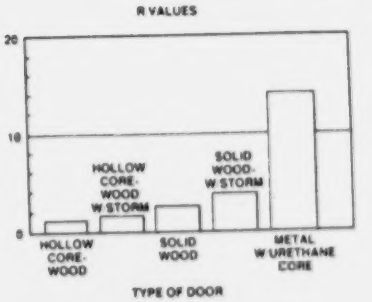

FIGURE 14-27 External doors on buildings can be a great source of heat loss. Always use a door with the maximum amount of R value.

Energy Conservation Tips

Individuals can conserve energy in many ways. The following are some of the more important techniques a person can use:

1. Dust all light bulbs regularly.
2. Switch lights off when not in use.
3. Use larger-wattage bulbs in lamps; they are more efficient.
4. Reduce the temperature in the home to 68°F.
5. Close off heating vents in rooms that are not used.
6. Close drapes at night to eliminate heat loss through windows.
7. Replace furnace filters regularly.
8. Wash and dry only full loads of laundry.
9. Install flow restrictors on faucets and showers.
10. Fill refrigerators and freezers to capacity; they operate at maximum efficiency when full.

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Recycle for Reuse - A 4-H Leader, Member, Family Guide

STATED GOAL:

A set of activities designed to make recycling a part of the lives of the participants.

FORMAT:

A 45-page booklet with introductory pages followed by 12 activities for elementary, junior high students. Each activity provides further sources of information.

AVAILABILITY:

Prepared by Cooperative Extension Service, University of Wisconsin - Extension. Available free from:
Waste Education Coalition Clearinghouse
Minnesota Waste Management Board
Sue Thomas, Waste Education Planner
1350 Energy Lane
St. Paul, MN 55108
(612)649-5483

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, contexts)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Health, Social Science

WHY SHOULD WE CARE

Recycling becomes more important ALL the time.

BECAUSE ..

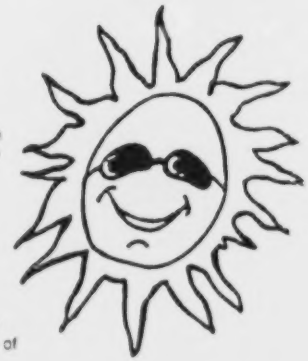
Recycling conserves natural resources.

Nature s supply of raw materials for people to use are limited but demand for them just seems to keep increasing. (It takes 17 trees to make one ton of paper and four tons of ore to make one ton of aluminum!)

Recycling saves energy.

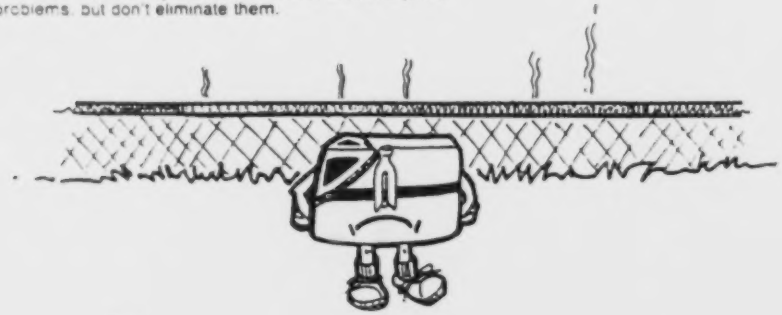
Making paper from recycled materials takes 40 percent less energy than making it from raw materials.

Steel made of scrap takes 86 percent less energy. Aluminum from scrap takes 96 percent less energy. Copper from scrap takes 91 percent less energy.



Recycling protects our environment.

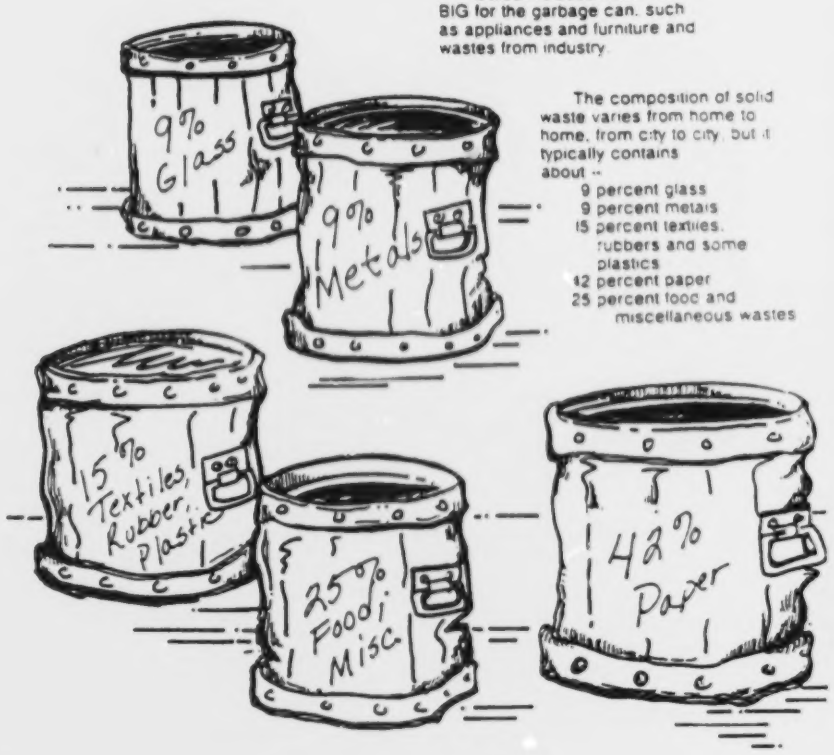
Even when garbage and trash is out of sight, it can still cause problems such as water pollution, bad smells and the buildup of dangerous gases. Trash can also attract disease-carrying animals. Modern-day landfills decrease waste disposal problems, but don't eliminate them.



WHAT IS SOLID WASTE?

It is anything we put in our garbage can. That includes anything from potato peels, cans and paper, to lawn and garden refuse and old clothing.

It also includes items too BIG for the garbage can, such as appliances and furniture and wastes from industry.



The composition of solid waste varies from home to home, from city to city, but it typically contains about --

- 9 percent glass
- 9 percent metals
- 15 percent textiles, rubbers and some plastics
- 42 percent paper
- 25 percent food and miscellaneous wastes

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Re: Thinking Recycling - An Oregon Waste Reduction Curriculum

STATED GOAL:

To teach children about the necessity of recycling and waste reduction, as it is practiced in Oregon.

FORMAT:

Divided into 5 levels: K-1, 2-3, 4-5, 6-8, and 9-12. Each level with lessons and extensions. There is also a section of masters for overhead transparencies. Sample lessons include: Costs of Packaging, Plastics, Local Garbage, Economics of Recycling.

AVAILABILITY:

Prepared by Oregon Department of Environmental Quality. Available free from:

Waste Education Coalition Clearinghouse
Minnesota Waste Management Board
Sue Thomas, Waste Education Planner
1350 Energy Lane
St. Paul, MN 55108
(612)649-5483

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Social Science, Language, Math, Music, Science

INTERDISCIPLINARY ACTIVITIES

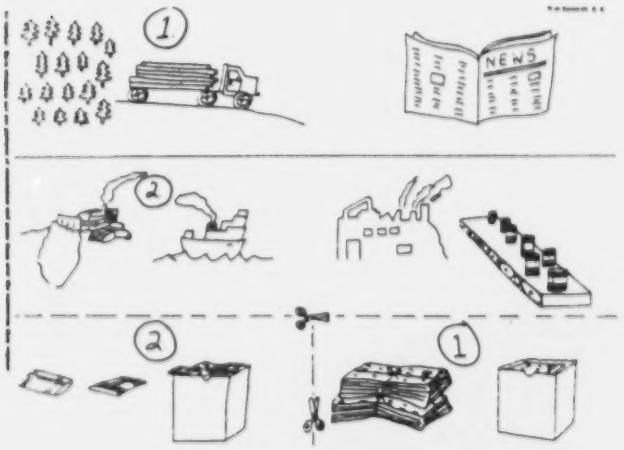
Art: Have students draw a picture of a landfill with the trucks dumping the trash and the bulldozers covering the trash with dirt.

Social Studies: Students would enjoy watching a garbage truck pick up school or neighborhood trash. You may be able to schedule a special stop for your class and have the hauler tell about his or her job and how the truck operates.

Language Arts: If there is a sand table and small trucks in your classroom, students can act out typical trash pickup and landfilling. They may want to use magazine pictures of things which will go to the landfill.

Math: Chart the number of cans of trash students' families throw away each week. Keep the chart to see if there is any change in the near future. You may want to inform parents of the chart and how your class is working to reduce the number of cans.

Social Studies: If your school is recycling, your students may enjoy being responsible for picking up recyclable papers from other classrooms, or the office. This could be one of the "helper" jobs.



GRAND TOTAL _____

IF YOUR SCORE WAS

40 or more

You're contributing a great deal of trash to our rapidly-filling landfills, including 5,000 tons of reusable, recoverable materials which are thrown away each year!

what you can do!

- Become more aware of the amount of trash you throw out every day. What could be reused, recycled, or avoided completely?
- Next time you go to the store, see if products you usually buy in nonrecyclable containers are also available in returnable, refillable, or recyclable containers.
- Call your local government, garbage collector, or recycler for information on how, when, and where to recycle. Or call DEQ toll-free, 1-800-452-408. In the Portland area, call the Metropolitan Service District, 224-5555.

between 21 & 39

Pretty good! It's obvious you're doing some reusing, recycling, and reducing the amount of trash you throw out. These habits need to be practiced consistently by every Oregonian if we're to reduce the ever-increasing quantity of waste produced in our state.

what you can do!

- Look at various types of packaging and the available alternatives. Does it cost you more or less to buy reusable or recyclable packages?
- Reuse plastic sacks; bring your own grocery bags to the supermarket.
- Look around your home for more items to recycle and phone your local government, garbage collector, or recycler for information. Or call DEQ, or, in the Portland area, Metro (see phone numbers, left column this page).

20 or less

Congratulations! Obviously you've done some serious thinking about the need for waste reduction and recycling. You're helping ensure that future generations will enjoy Oregon's natural resources, pristine beauty, and famous "quality of life." You're also providing jobs for the many Oregonians working in state industries that use recycled materials to make new products.

what you can do!

- Encourage one other person to recycle. You set a good example!
- Write letters, attend meetings. Get involved in solid waste management in your community.
- Give yourself a pat on the back and keep up the good work!

LESS IS BETTER when it comes to garbage and energy consumption

64

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Science-Technology-Society: Preparing for Tomorrow's World

STATED GOAL:

A multi-disciplinary approach to problem solving and critical thinking designed to promote decision-making and problem-solving skills needed to deal with issues at the interface of science, technology, and society.

FORMAT:

Twelve independent modules: Energy Use and Conservation; Coastal Issues; Technological Change; Transportation; Communications; Medical Technology; Urban Land Development; Cultural Impact; Space Travel

AVAILABILITY:

Two days training required before ordering materials. Modules vary in price; average $60 per unit. Contact:

Genelle Bentley
N & C MN Reg. State Facilitator
HCR 3, Box 15
Staples, MN 56479
(218)894-1930

-or-

Gail Goltz
SW & WC ECSU
SW State University
Marshall, MN 56258
(507)537-1481

-or-

Diane Lassman
116 University Press Building
University of Minnesota
Minneapolis, MN 55414-3092
(612)624-0584

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH AREAS CAN IT BE INTEGRATED?

Science, Math, Social Science

PART C — An Evaluation of Possible Effects

• Meet in small groups of 3 to 5 students to briefly discuss the dilemma, "Acid Rain and Jobs." Consider some of the "Discussion Questions" in your analysis of the situation.

• Your teacher will distribute Student Handout 2, "An Evaluation of Possible Effects." (See sample on the next page.) On the worksheet, list some of the possible consequences of Governor Jones' decision. If he continues to permit the use of high sulfur coals, the soil and water in the park would become more acid. If he withdraws the permit, the glass companies would close and the cost of electricity would increase.

• List the consequences-effects in both the immediate and future categories.

• According to your opinion, how harmful is each effect? Indicate the level of severity with a number from 1 to 4 in the "Harm" column.

4 = most harmful
3 = very harmful
2 = somewhat harmful
1 = least harmful

• Review the readings for additional information to help you complete the worksheet. You may also wish to consider some of the consequences of strip mining low sulfur content coal.

• This worksheet may be completed individually or with your group members. If the worksheet is done individually, each person will present his/her analysis to the group for discussion. The findings are then combined to produce a group report.

• From the results select 1) what the group believes are two of the most harmful effects from a short term perspective; and 2) what the group believes are two of the most harmful effects from a long term perspective. List these for the class to examine.

• After examining the consequences with the entire class, try to reach a consensus as to what Governor Jones should do. What are the best reasons for supporting this decision?

ACTIVITY 5: UNINTENTIONAL WEATHER CHANGES

PART A — Air Pollution and Rainfall — Introductory Reading

• **Reading 8: "Changes in the Weather"**

This reading illustrates one of the more dramatic cases of the effects of human activity (production and consumption) on climate. However, this effect is not new or novel. Cities have long been recognized as "heat islands." London's "killer" fogs have been attributed to the burning of coal as early as the 13th Century. Consequently, coal burning was prohibited in London.

Student Activity: Dilemma Discussion

• **DILEMMA 3: "Rain, Unwanted at Harvest Time"**

Effects of industrial activity frequently extend well beyond the immediate area, and such effects are not necessarily welcomed. While this dilemma raises the issues of inequity for those people who must bear the detrimental effects, the underlying question to be resolved is, "How can government/public regulate or modify these inadvertent changes?"

Follow the procedure for conducting dilemma discussions as suggested in this Teacher's Guide.

PART B — "Changing Climate - Changing Activities?"

Description

In this activity students will consider the possibility of a climatic change in their local area and examine how family and community activities might change. This exercise illustrates the idea that human activities are greatly influenced by climatic conditions. That idea, in fact, has led numerous scholars to postulate theories of "climatic determinism" to explain the evolution of different customs, social interrelationships, and political and economic systems.

Student Objectives

• To project situations of different climatic conditions in their locale.

• To consider how their lifestyle might change to adapt to the new climatic conditions.

Student Activities

• Students, individually, will complete Student Handout #1, *Changing Activities*, in which they will consider how the different categories of activities might be changed if climate conditions became "hotter and wetter" and "hotter and drier." Table 2 illustrates changes predicted by Dr. Hass, a sociologist, under a different set of climate changes. This table should be examined closely before students complete their own table.

• Upon completion of their individual tables, students will convene in small groups (3 to 6) to compare their analysis and discuss their predictions. The group members will summarize their ideas about how different activities change when the climate changes for a short class presentation.

Comments and Suggestions

• Students have difficulty envisioning change or even thinking about the future. For example, Alvin Toffler, who wrote *Future Shock*, Conducted an experiment with several groups of teenage students. He asked them to make forecasts of the future and then predict events in their personal future. The disparity in the two forecasts was astonishing. Students made predictions about new technologies, robot computers, a world of upheaval and the like. In contrast, their own personal list read like a diary of their life today. They were unable to think of change in their own personal lives; they didn't see themselves as participants or being affected by change.

Therefore, to help students develop the notion of change, it will be useful to examine Table 2 in the Student's Manual with the entire class. For each of the predicted changes have the students provide an example from their personal experiences. For example, with colder and wetter weather conditions, Dr. Hass predicted "increased sibling interaction." Ask the students what they do when they have to spend most of the day inside their house. Their responses will begin to illustrate how the author arrived at his conclusion. Use this procedure for the other activities.

• You may wish to assign each group to examine change for a given season or the year. Analyzing one season at a time will perhaps prove to be less confusing for the students.

PART C — "Acid Rain" — Introductory Readings

• **Reading 9:** "Acid Rain" Fallout: Pollution and Politics

• **Reading 10:** "Pollution Parley"

The two readings define "acid rain," its source and its effects. These readings, particularly Reading 9, are more technical in nature. You may wish to assign stu-

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SECONDARY ENERGY EDUCATION CURRICULUM MATERIALS

TITLE:

Transportation, Energy, and Power Technology

STATED GOAL:

To teach students to make decisions using an easy-to-understand "systems model" which shows how input, process, output, impacts, and feedback work together in transportation, energy, and power technology. Emphasis is on how energy and power systems support transportation technology.

FORMAT:

416 pp., 8 x 10, hardcover, 1989. Transportation (8 chapters); Energy (6 chapters); Power (5 chapters); plus a final chapter addressing the future of these technologies. Full-color illustrations and pedagogical aids in every chapter (objectives, key terms, hands-on activities, review questions, and summaries). Math appendix explains important terms and formulas.

AVAILABILITY:

For additional information and/or to place an order, contact:

Customer Service Department
Delmar Publishers, Inc.
Two Computer Drive West
Box 15015
Albany, NY 12212
1-800-347-7707
Fax: 518-459-3552

Note: All prices are tentative and subject to change without notice.

Text	Order #3227-0	$25.30 List/$18.97 Net
Instructor's Guide	Order #3228-9	$12.00 List/$ 9.00 Net

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Math, Social Science, Technology Education

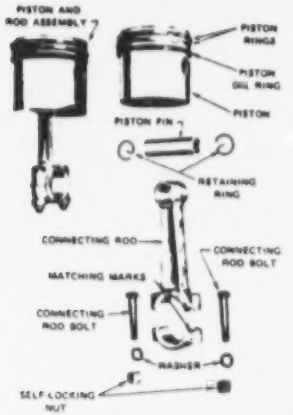

Fig. 3-11 Piston, piston pin, connecting rod, and associated parts for free-floating piston assembly (Courtesy Tecumseh Products Company)

hollow; the hollow piston pin has the advantage of being lighter in weight. Because piston pins are subjected to heavy shocks when combustion takes place, high-tensile strength steel is used. To keep noise at a minimum, the piston pin fits to a very close tolerance in the connecting rod. The piston pin does not rotate. It has a rocking motion similar to the action of the wrist when the wrist is moved back and forth, hence the name *wrist pin*. Heavy shocks, close tolerances, and the rocking motion make the lubrication of this part difficult. In most engines, lubricating oil is squirted or splashed on it.

Connecting Rod

The connecting rod connects the piston (with the aid of the piston pin) and the crankshaft, figure 3-12. Many small engines have cast aluminum connecting rods; larger engines can have steel connecting rods. Generally, the cross section of the connecting rod is an I-beam shape for strength. The lower end of the connecting rod is fitted with a cap. Both the lower end and the cap are accurately machined to form a perfect circle. This cap is bolted to the rod, encircling the connecting rod bearing surface on the crankshaft. Many connecting rods are fitted with replaceable bearings surfaces called rod bearings or inserts. These are used especially on heavy-duty or more expensive engines.

Crankshaft

The crankshaft is the vital part that converts the reciprocating motion of the piston into rotary motion. One end of the crankshaft has a provision for power takeoff (connecting accessory to use engine's power) and the other is machined to accept the flywheel.

Crankshafts are made of high-quality steel; they are carefully forged and then machined to close tolerances. Their bearing surfaces are large because they must accept a great amount of force. Since they revolve at high speeds, they must be well balanced. Figure 3-13 is an example of a single-throw crankshaft.

Figure 3-14 shows two types of small engine designs. Engines designed with *vertical* crankshafts are shown in figure 3-15. Vertical crankshafts are excellent for applications such as rotary power lawn mowers where the blade is bolted directly to the end of the crankshaft. Most wheeled applications such as motorbikes and go-carts use *horizontal* crankshaft engines which enable the power

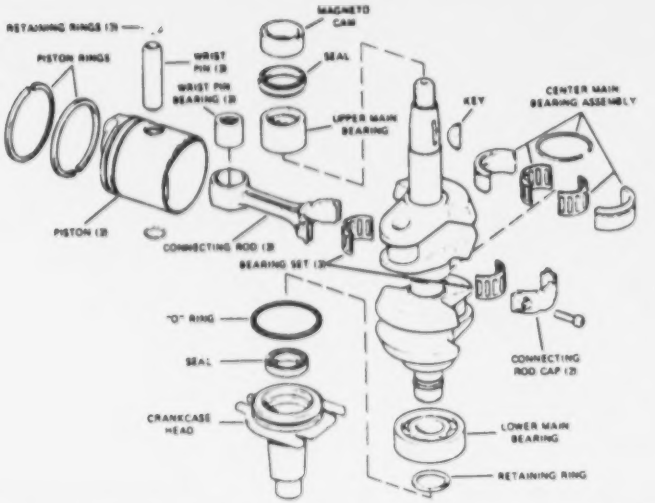

Fig. 3-12 Crankshaft, pistons, and connecting rod components — two-cycle, two-cylinder engine (note crankshaft)

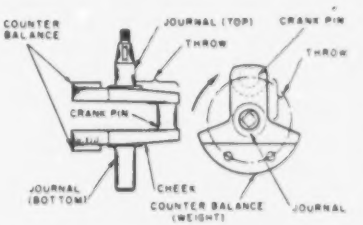

Fig. 3-13 Single-throw crankshaft: one crank pin for one cylinder

to be delivered to an axle through belts or chains. Multiposition engines such as chain saws are another variation. The crankshafts themselves are much the same but other changes in engine design are necessary to meet the requirements of crankshaft position. An engine can have clockwise or counterclockwise crankshaft rotation, depending upon its application and design.

Crankcase

The crankcase is the body of the engine. It houses the crankshaft and has main bearing

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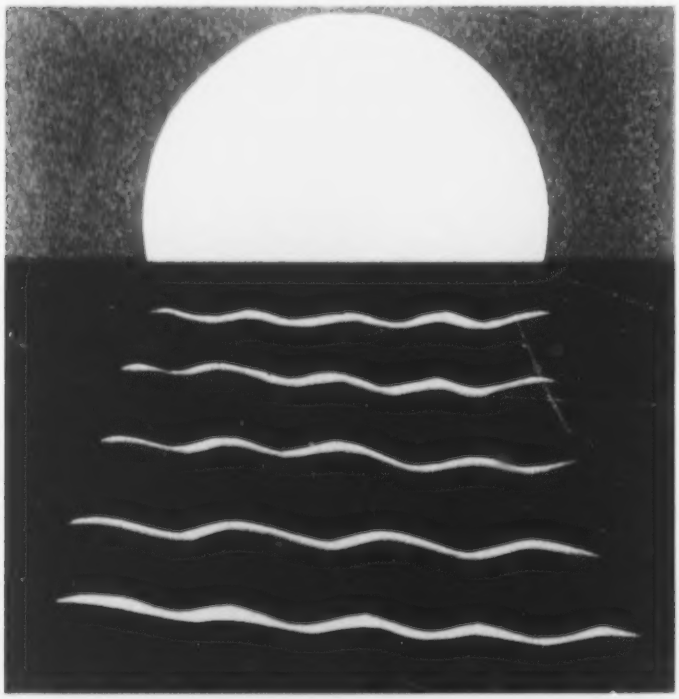

RESOURCES

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Acid Rain Curriculum: Grades 4-8

STATED GOAL:

To provide learning activities on the problems of Acid Rain.

FORMAT:

Twelve interdisciplinary activities including lesson plans and student pages. Subjects of Science, Math, Social Science, Art, and Language Arts. Includes information, poster, and pH paper.

AVAILABILITY:

Cost: $23.95, prepaid only. Available from:
The Acid Rain Foundation
1410 Varsity Dr.
Raleigh, NC 27606
(919)828-9443

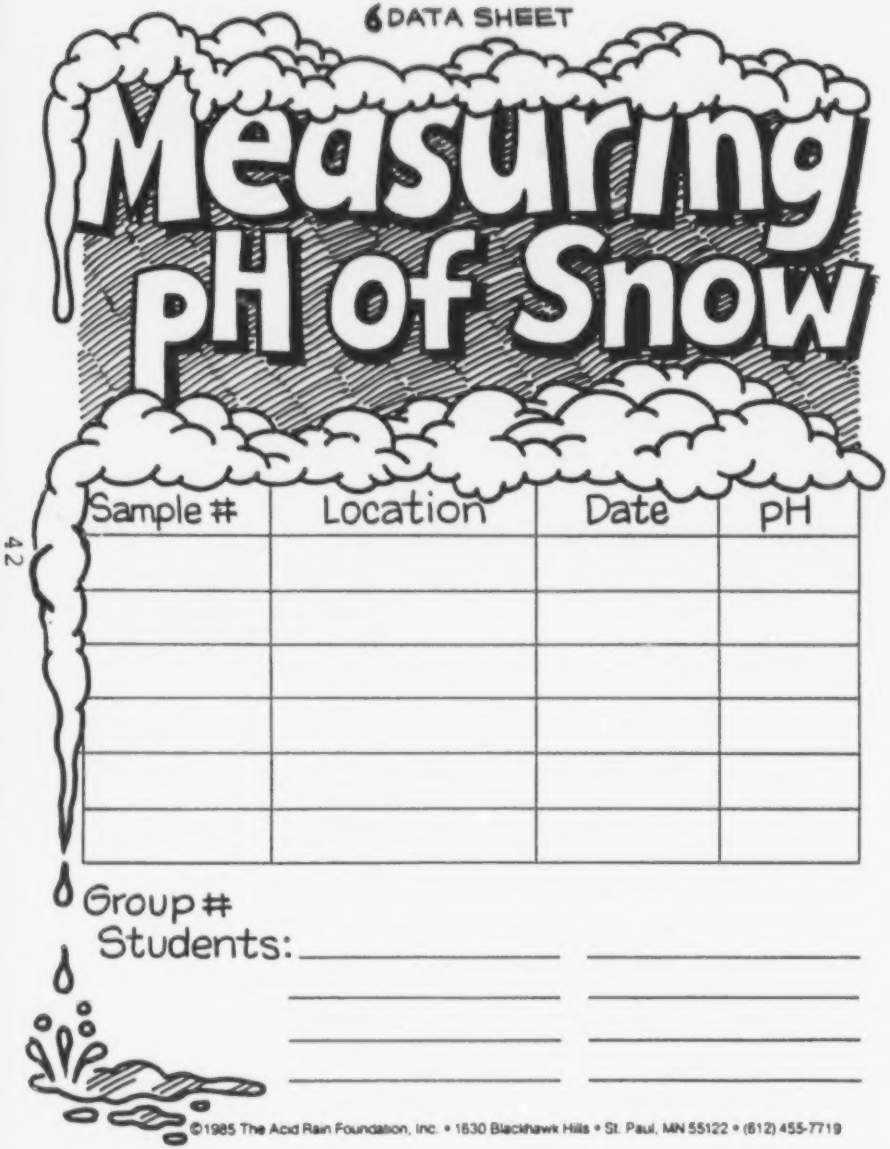
TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Because of the nature of the subject all of the contexts are addressed in this material.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Social Science, Science, Math, Language, Art

6 DATA SHEET



©1985 The Acid Rain Foundation, Inc. • 1630 Blackhawk Hills • St. Paul, MN 55122 • (612) 455-7719

Time

Several periods of 30 minutes

Objectives

During this activity, students will:

1. Collect samples of local snowfall
2. Test the pH value of the samples

Students will test samples of local snowfall to see if it is "acid". The testing results are appropriate for elementary students, but may not be strictly accurate scientifically.

Class Organization

Groups of 6-8 students working in the schoolyard and classroom

Materials

Copies of data sheet
pH paper (pH 3-pH 6) and color charts
Empty potato chip can or similar clean cylinder
Selfsealing plastic bags
Masking tape, pens

Prior to Activity

Have students read the following sections of the student reader:

"Acid/Neutral/Base", "pH Scale", and "Acid Rain".

Procedure

FIRST PERIOD

Begin by asking these questions:

1. What does pH mean?
2. What is the pH of pure rain? Is it acid or base? Is that true for pure snow?
3. At what pH level is snow called "acid"?
4. What are the different forms of acid rain?
5. Is it dangerous to go out into acid snow?
6. How is the pH of a liquid measured? How will we measure the pH of snow?

SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Acid Rain in Minnesota, Teacher's Resource Guide

STATED GOAL:

To provide learning activities to accompany Acid Rain in Minnesota, a booklet by The Acid Rain Foundation, MN PCA, DNR, Dept. of Health, and Dept. of Education.

FORMAT:

Seventeen interdisciplinary activities in Economics, Literature, Government, Environmental Studies, Speech, and Drama, to accompany Acid Rain in Minnesota, 1985.

AVAILABILITY:

Cost: $10, prepaid only. For Teacher's Guide and Acid Rain in Minnesota. Available from:
The Acid Rain Foundation
1410 Varsity Dr.
Raleigh, NC 27606

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Because of the nature of the subject all of the contexts are addressed in this material.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Social Science, Speech, Drama.

EMISSIONS MAP

Figure 5. This map shows the major sources of sulfur dioxide emissions (more than 100 kilotons per year), common wind paths, and the areas of North America most sensitive to acid rain (after Galloway and Cowling, 1978).

STUDENT

EMISSIONS MAP

1. What are some things you notice about this map?

2. What do the arrows show?

3. Think about this map in terms of producers and consumers. What areas of th United States would you describe as producers of acid rain? Which are majo producers? Major consumers?

4. What is the relationship, if any, between producer areas, consumer areas an areas sensitive to acid rain?

5. Do the data on this map provide evidence of long-range transport of atmospheri pollution?

6. How is Canada affected?

7. Weather systems move from west to east. How could you explain the arrow which move from east to west?

8. Where are the greatest numbers of contributors to the acid rain problem?

9. Does the map provide any evidence about cause and effect? Why or why not?

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Acid Rain Learning Materials: Science, Environmental, and Social Studies, grades 7-12

STATED GOAL:

To provide users with information on the problems of Acid Rain.

FORMAT:

Loose leaf units (3-hole punched) for use in: Life Science, Earth Science, Physical Science, Biology, Chemistry, and Social Science

AVAILABILITY:

Cost: $55, prepaid only. Available from:
The Acid Rain Foundation
1410 Varsity Dr.
Raleigh, NC 27606 (919)828-9443

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Because of the nature of the subject all of the contexts are addressed in this material.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Social Science, Science

Overview

The implications of futures wheel is one of the most popular and useful conceptual tools in the futurist's tool kit. It can be used to imaginatively explore the domain of the possible. In this activity, students use this multiple right-answer tool to explore the implications of acid deposition.

Objectives

Through their experiences in this work, it is hoped that students will be able to:

- use a tool designed for understanding and dealing with problems of a systemic nature.
- discuss their responsibility for the future.
- sense the importance of their involvement in complex and long-term environmental issues.

Materials

Overhead projector
Newsprint/butcher paper
Markers/crayons

Teacher preparation

1. The futures or implications wheel is a tool which is used to explore the possible. It is not a decision making tool. It can be used to dramatically increase awareness of some of the implications of: trends, innovations, policies, or goals. It will take about one period to teach students to use the futures wheel.

2. TO USE THE FUTURES WHEEL:

   A. START A DIAGRAM
   (An incomplete example of an implications wheel is included.)

   Write the trend/innovation/policy/goal in the center of a sheet of paper, chalkboard or on an overhead transparency. Circle it.

   B. ASK ONE OF THESE QUESTIONS:

   1. What might occur as soon as (trend, innovation, policy, or goal) is introduced to society?

      OR

   2. What might happen if (trend, innovation, policy, or goal) continues to (increase, decrease, occur) in the future?

C. RESPONSES

As students respond, place the responses around the central "hub" or node, circle each one and connect it with a single line to the central node. These responses are called first order implications. They are indicated by a single line.

D. NEW IMPLICATIONS

For each of these nodes or first order implications ask: What things might occur as soon as this possibility happens? Connect the new implications with two lines. Continue this processs for about four or five orders of implications.

Third order implications are connected by three lines; fourth order implications by four lines and so forth. Futures wheels can get out of control — sixth order implications represent a natural upper limit.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Aquatic Project WILD

STATED GOAL:

To assist learners of any age to develop an awareness, knowledge, skills, and commitment to result in informed decisions, responsible behavior, and constructive action concerning wildlife and the environment, with emphasis on the water environment.

FORMAT:

A paperbound book of 240+ pages containing over 40 activities arranged under these headings: Awareness and Appreciation; Diversity of Wildlife Values; Ecological Principles; Management and Conservation; People, Culture, and Wildlife; Trends and Issues; and Responsible Human Actions.

AVAILABILITY:

Guides available only through participation in a workshop. For information and for workshop schedules, contact:
Project WILD Coordinator - Minnesota
Box 5 DNR Building
500 Lafayette Rd.
St. Paul, MN 55155-4005
(612)297-2423

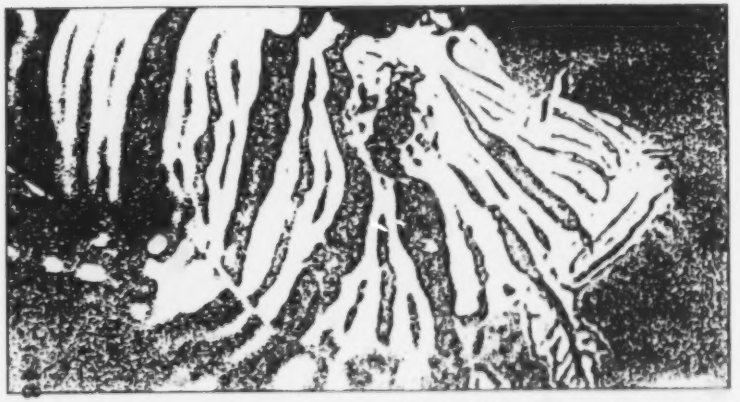
TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Social Science, Health, Music

FASHION A FISH



Objectives

For Younger Students Students will be able to classify fish according to body shape and coloration.

For Older Students Students will be able to: 1) describe adaptations of fish to their environments; 2) describe how adaptations can help fish survive in their habitat; and 3) interpret the importance of adaptations in animals.

Method

Students design a variety of fish adapted for various aquatic habitats.

Background

Aquatic animals are the product of countless adaptations over long periods of time. These adaptations, for the most part, are features that increase the animals' likelihood of surviving in their habitat.

When a habitat changes, either slowly or catastrophically, the species of animals with adaptations that allow them many options are the ones most likely to survive. Some species have adapted to such a narrow range of habitat conditions that they are extremely vulnerable to change. They are over-specialized and are usually more susceptible than other animals to death or extinction.

In this activity, the students design a kind of fish. They choose the adaptations that their fish will have. Each choice they make would actually take countless years to develop. As these adaptations become part of the fish's design, the fish becomes better suited to the habitat in which it lives. Because of the variety of conditions within each habitat, many different fish can live together and flourish. Some adaptations of fish are shown in the table that follows.

Age: Grades K–12
Subjects: Science, Art
Skills: analysis, application, classification, communication, description, discussion, drawing, identification, inference, invention, media construction, public speaking, reporting, small group work
Duration: two 30-45 minute periods for older students; one or two 20-minute periods for younger students
Group Size: any, groups of four students each
Setting: indoors or outdoors
Conceptual Framework Reference: III.A.3., III.D., III.D.1., III.D.2., III.D.3.
Key Vocabulary: adaptation, coloration, camouflage, habitat

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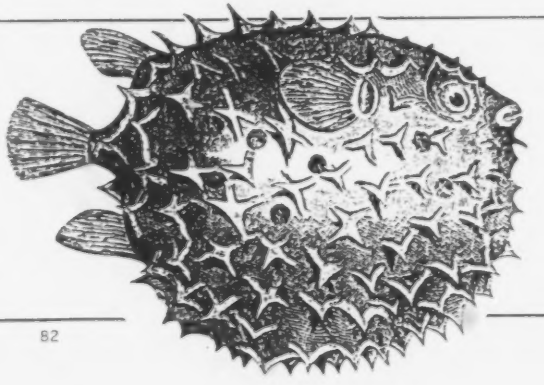
ADAPTATION	ADVANTAGE	EXAMPLES
Mouth		
sucker shaped mouth	feeds on very small plants and animals	sucker, carp
elongate upper jaw	feeds on prey it looks down on	spoonbill, sturgeon
elongate lower jaw	feeds on prey it sees above	barracuda, snook
duckbill jaws	grasps prey	muskellunge, pike
extremely large jaws	surrounds prey	bass, grouper
Body Shape		
torpedo shape	fast moving	trout, salmon, tuna
flat bellied	bottom feeder	catfish, sucker
vertical disk	feeds above or below	butterfish, bluegill
horizontal disk	bottom dweller	flounder, halibut
hump backed	stable in fast moving water	sockeye salmon, chub, razorback sucker, coho salmon
Coloration		
light colored belly	predators have difficulty seeing it from below	most minnows, perch, tuna, mackerel
dark upperside	predators have difficulty seeing it from above	bluegill, crappie, barracuda, flounder
vertical stripes	can hide in vegetation	muskellunge, pickerel, bluegill
horizontal stripes	can hide in vegetation	yellow and white bass, snook
mottled coloration	can hide in rocks and on bottom	trout, grouper, rockbass, hogsucker
Reproduction		
eggs deposited in bottom	hidden from predators	trout, salmon, most minnows
eggs deposited in nests	protected by adults	bass, stickleback
floating eggs	dispersed in high numbers	striped bass
eggs attached to vegetation	stable until hatching	perch, northern pike, muskellunge, carp
live bearers	high survival rate	guppies



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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

ECOLogy: Environmental Career-Oriented Learning

STATED GOAL:

Infusing ecological concepts, career information, and futures understandings into basic skills subject matter.

FORMAT:

Units called Environmental Learning Experiences and supporting Project Activity Kits; there are 6 primary, 14 intermediate, and 8 secondary units. Units focus on energy, water, air, solid waste, and noise.

AVAILABILITY:

Prices vary from $200.00/grade level and up. Contact:

Genelle Bentley
N & C MN Reg. State Facilitator
HCR 3, Box 15
Staples, MN 56479
(218)894-1930

-or-

Gail Goltz
SW & WC ECSU
SW State University
Marshall, MN 56258
(507)537-1481

-or-

Diane Lassman
116 University Press Building
University of Minnesota
Minneapolis, MN 55414-3092
(612)624-0584

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH AREAS CAN IT BE INTEGRATED?

Science, Social Science, Career Education

LESSON 14

(to be used after weigh in #7 (Lesson #4) on Monday)

CONCEPT: Students see how critical the food shortage problem is world wide.

MATERIALS: Film: "Food or Famine" (29 min.)

PROCEDURE: Say - *We have studied future trends in food production. The film you are going to see shows what happens when we don't plan ahead (famine) and then gives us some additional ideas on how to use ecology methods to prevent mass starvation.* (Show film - 29 min.)

EVALUATIVE ACTIVITY: Ask - *What are some of the reasons for famine?* Encourage and discuss all answers. *What can be done to avoid famine?* Again, encourage and discuss all answers thoroughly. *What could you as one person in situations similar to those in the film do to avoid famine? What could a government do? Whose responsibility is food production? Why?* Encourage answers and discuss each thoroughly until you feel students see that everyone must share in the responsibility and do his part through being informed and being aware of current and future situations.

EXTRA ACTIVITY: See activity cards in back.

LESSON 15

½ hour

CONCEPT: How we can produce more food.

MATERIALS: paper
pencils
overhead projector

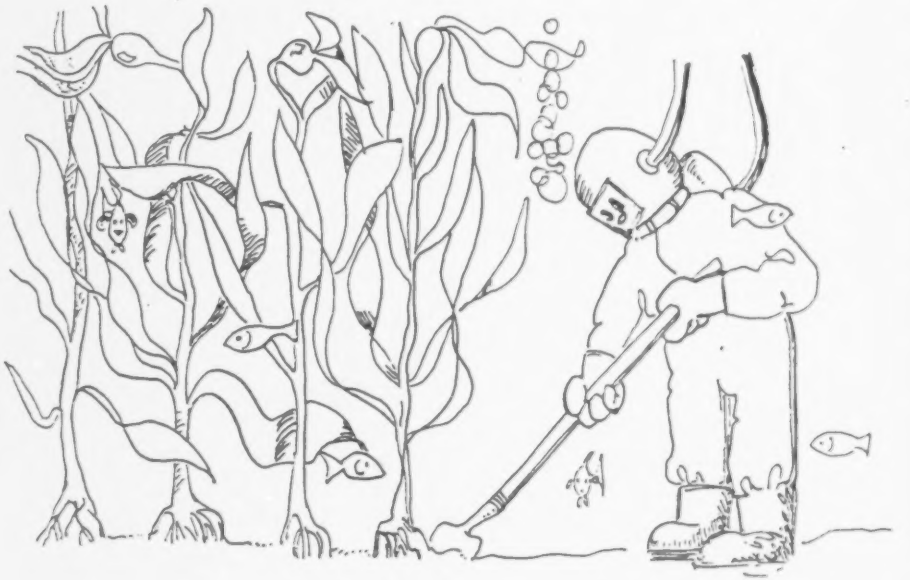
PROCEDURE: Divide class into 5 groups. Tell them: *You have seen several films which show what will happen if we don't solve our growing food shortage. You have also seen in the films ways that we can increase food production.*

EVALUATIVE ACTIVITY: *Your group is to make a list of as many solutions to the food crisis as they can in the next 15 minutes.* When the time is up have each group read their list. Write the items on the overhead, making a master list for everyone to see.

Discuss each item as it is volunteered. Perhaps students will think of solutions that they had not previously thought of.

EXTRA ACTIVITIES: See Activity Cards.

food or famine



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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Environmental Education Activity Sampler

STATED GOAL:

To share 8 environmental learning activities used successfully by teacher members of Metro Regional Environmental Education Council

FORMAT:

Photo-copied and stapled 8½ x 11 sheets

AVAILABILITY:

Contact: Metro Regional Environmental Education Council
Box 5, DNR Building
500 Lafayette Rd.
St. Paul, MN 55155
(612)296-2368

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Social Science

ENVIRONMENTAL EDUCATION ACTIVITIES SAMPLER #4

TRUMPET OF THE SWAN

ON YOUR MARK —

SUBJECT AREAS: Language Arts, Art

OBJECTIVES: To distinguish factual from fictional information about the trumpeter swan

Emphasizes the natural context; valuing and action contexts are integral to activity 6.

GET SET —

Locate a copy of Trumpet of the Swan by E.B. White.

GO —

- Read Trumpet of the Swan to your students or, if enough copies are available, they could read it independently.
- Possible Activities:

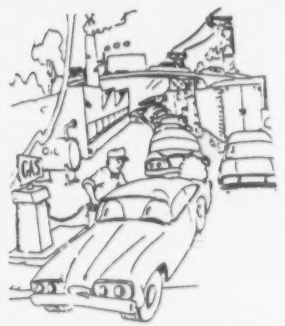
1. In chart form, list factual and fictional information about trumpeter swans as presented in the book.
2. Prepare a brief oral report on the natural history of trumpeter swans and present it to the class.
3. Illustrate the natural habitat of trumpeter swans and one of Louis' fictional habitats.
4. Prepare a bibliography of trumpeter swan resources available in your media center. Read one of them and compare to the information given in Trumpet of the Swan.
5. Select a familiar wild animal. Write a fictional story that identifies a problem that the animal has and how he/she solves it. Model it after Trumpet of the Swan.
6. Call or write for information on the impact of people on the trumpeter swan population and what is currently being done in Minnesota to increase their population. (MN Dept. of Natural Resources, Bureau of Information and Education, Box 46, DNR Bldg., 500 Lafayette Road, St. Paul, MN 55155 (296-3336)
7. Prepare a listing of other books from your media center that fictionally represent a wild animal.

meeb reec

Provided as a service to teachers by the Minnesota Environmental Education Board's Metro Regional Environmental Education Council, a unit of the MN Department of Natural Resources.

ENVIRONMENTAL EDUCATION ACTIVITIES SAMPLER #

RESOURCE RECOVERY LABORATOF



ON YOUR MARK —

SUBJECT AREAS: Science, Math, Social Studies

OBJECTIVES: Students will experience a search for limited resources and graph simulated resource development rate data.

This is a great exercise to begin a unit on energy use.

Emphasizes social and valuing contexts.

GET SET —

You will need one cup each of red, blue, green, and white rice. I prepare the colored rice by using a concentrated food coloring solution and drying the rice in the oven at very low temperature (too high temperature will crack the rice). You will need one cup of alfalfa seeds (used for sprouting and can be purchased at local food coops). Coarse ground corn meal may be substituted for the alfalfa but it is not as good. You will end up with enough material to repeat the exercise with at least six classes.

Prepare a glass of seeds before class. Put the same measured volume of each color rice and the alfalfa seeds into a glass. I use about 20 ml. or approximately 1/8 of a cup of each seed.

Prepare the room by making a small open area in the center by moving desks a little bit off to the side. Remind the students that this is going to be a simulation. Have the class count off by 5's and move each "team" to its own special area around the outside of the room. Give the teams 30 seconds to choose a captain. Give each captain a paper cup and designate the red, white, green and finally the alfalfa team. (Good for a laugh.)

GO —

Now the fun! Standing in the middle of the room, take about 1/3 of the seeds in your glass and scatter them out under chairs and desks like you are feeding the chickens. With a finishing flourish, scatter the rest by tossing them up to hit the ceiling so that most fall in the center area. The teams will immediately guess what their task will be.

Announce the rules...1. Pick up your own color only at one minute intervals. 2. Please stop when time is called. 3. Go directly to your team area and count seeds. 4. Captains bring seeds to the teacher and report the number. 5. Teams wait until all have reported and the teacher gives the go ahead for the next interval of rice picking.

Over...

meeb reec

Provided as a service to teachers by the Minnesota Environmental Education Board's Metro Regional Environmental Education Council, a unit of the MN Department of Natural Resources.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Environment and Technology Project
Chicago, IL

STATED GOAL:

An interdisciplinary curriculum which enables students to understand the impact of science and technology on the environment and actively engages them in a problem-solving approach, as citizens able to make decisions based on sound technological choices.

FORMAT:

Sixteen units in 4 categories: energy, land use, pollution, urban management; worksheets, teacher's handbook.

AVAILABILITY:

Two days training required before ordering materials. Average cost per set $130. Additional student units available at $4.25 each. Contact:

Genelle Bentley
N & C MN Reg. State Facilitator
HCR 3, Box 15
Staples, MN 56479

-or-

Gail Goltz
SW & WC ECSU
SW State University
Marshall, MN 56258

-or-

Diane Lassman
116 University Press Building
University of Minnesota
Minneapolis, MN 55414-3092
(612)624-0584

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH AREAS CAN IT BE INTEGRATED?

Science, Social Science

FOR HIGH SCHOOL SCIENCE
AND SOCIAL STUDIES TEACHERS

A CURRICULUM
ACTIVELY INVOLVING STUDENTS
IN THE STUDY OF

SCIENCE, TECHNOLOGY,

AND THE

ENVIRONMENT

54

Concern Regarding
THE ENVIRONMENT AND TECHNOLOGY
In Our Nation/Neighborhood

An Exemplary Educational Program
National Diffusion Network
U.S. Department of Education

THE ENVIRONMENT AND TECHNOLOGY PROJECT

This high school curriculum project is organized around societal issues that arise from rapid change in science and technology. It enables students to become informed citizens able to apply science and social science knowledge to resolving science-related social issues.

The project was initially developed by classroom science and social science teachers in LaSalle-Peru, Illinois who were concerned with increasing dangers to the environment that arise from advances in science and the use of science technology.

High school teachers in over 22 states and the District of Columbia are currently using this exemplary project in their high school courses. The curriculum is used in grades 9-12, with students of all ability levels in courses such as Biology, Ecology, Social Problems, and Science and Society.

OBJECTIVES

The curriculum is intended to teach three sets of objectives:

UNIVERSAL objectives - Interdependence, Impact, Maintenance, Quality of Life, Improvement - run like threads throughout the curriculum.

CATEGORY objectives are stated for the board topics of Energy, Land Use, Urban Management and Pollution.

UNIT Objectives are stated for each of the 16 individual curriculum titles.

CURRICULUM

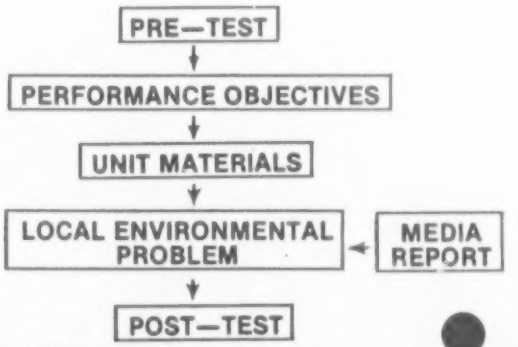
A student studies a minimum of one unit in each of these four categories in a semester:

Energy	Land Use
gasoline	urbanization and
electricity	zoning
nuclear power	streets and roads
coal	parks and recreation
solar	wildlife

Urban Management	Pollution
solid waste	air
waste water	water
population	noise
	rural

COURSE DESIGN

Students choose a unit, take a pre-test and move through units materials which are written to specific learner outcome objectives. The study of **local** environmental problems allows students to use their knowledge to integrate the classroom with the community. The post test helps the instructor and student evaluate growth.



SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

FAST: Foundational Approaches in Science Teaching (Grade 7)

STATED GOAL:

A full year course in the concepts and methods of the physical, biological, and earth sciences and their relation to the environment

FORMAT:

Student record book
Reference booklets
Teacher's guide

AVAILABILITY:

10 days of training required before ordering material. Price unavailable. Contact:

Genelle Bentley
N & C MN Reg. State Facilitator
HCR 3, Box 15
Staples, MN 56479
(218)894-1930

-or-

Gail Goltz
SW & WC ECSU
SW State University
Marshall, MN 56258
(507)537-1481

-or-

Diane Lassman
116 University Press Building
2037 University Ave. SE
Minneapolis, MN 55414-3092
(612)624-0584

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH AREAS CAN IT BE INTEGRATED?

Science

FAST 1 - THE LOCAL ENVIRONMENT

PHYSICAL SCIENCE

Unit 1 Introduction to the Properties of Matter
- A. Introduction to Buoyancy
- B. Thermal Effects on Buoyancy
- C. Buoyancy and Gases

Unit 2 Changes of State in Matter
- A. Melting and Boiling
- B. Gases and Liquids
- C. Conditions for Condensation

Unit 3 Temperature and Heat
- A. Temperature and the Measurement of Heat
- B. Conservation of Heat

RELATIONAL STUDY

Unit 1 - Air Pollution

ECOLOGY

Unit 1 Plant Growth
- A. Seed Germination
- B. Plant Propagation
- C. Scientific Reporting

Unit 2 The Physical Environment
- A. Soil
- B. Soil and Water
- C. Water in the Air
- D. The Air Around Us
- E. Water All Around Us
- F. Water Out of Plants

Unit 3 Animal Care

Unit 4 Field Ecology
- A. Field Survey
- B. Sampling Techniques
- C. Ecology of the Class Study Area

FAST 1 studies are designed to capitalize on the excitement of discovery and to get students involved in the activities of science. The students are directed toward investigation of the local environment to find basic biological, geological, and meteorological interrelationships in natural system.

FAST 1 topics and problems lend themselves to the development of basic principles of physical and ecological sciences. Data, for the most part, point to specific conclusions. Skills are developed for handling data, designing experiments, and interpreting results, as well as for manipulating standard laboratory equipment.

FAST 1 - SAMPLE LESSON

27. HEIGHT OF LIQUID COLUMNS IN A TORRICELLI TUBE

Background

In an earlier investigation, air was removed from a Torricelli tube containing mercury and another containing water. The height of the water column was greater than the mercury column. Let us now investigate the relative heights to which other liquids will rise when air is removed from a Torricelli tube.

Problem

How high do different liquids rise in a Torricelli tube when the same amount of air is removed from the tube?

Procedure

1. Assemble and adjust the equipment as shown in Figure 27–1.
   a. Fill the syringe ¼ full with air and attach it to the equipment as shown.
   b. Check for leaks in the system by opening the clamp and pushing the syringe plunger all the way in. If there are no leaks, air will bubble out of the tube through the liquid in the container.
   c. Use the syringe plunger to adjust the level of the liquid in the tube to "0" cm on the meter stick. Close the clamp.
   d. Remove the syringe from the tube and empty it of air.
   e. Reconnect the empty syringe to the equipment. The apparatus is now ready for use.

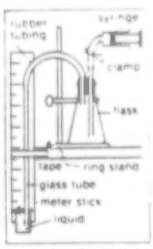
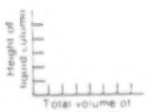
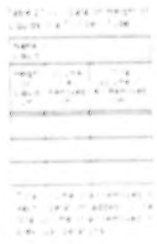


Figure 27–1 Equipment for measuring the heights of liquid columns in a Torricelli tube.

NOTE: Be sure that no strain is placed on the rubber tubing during the operation of the syringe.

2. Determine the height to which a liquid rises in a Torricelli tube when some air is removed from the tube. Record the name of the liquid in a table similar to Table 27–2.



   a. Open the clamp and pull the syringe plunger back about 5 ml.
   b. Clamp the tube and release the plunger. After the plunger is released record the volume of air removed and the height of the liquid in the tube. The volume of air removed is that volume of air in the syringe after the plunger is released.
   c. Disconnect the syringe from the tubing.
   d. Empty the syringe of air and reattach the syringe to the tubing.
   e. Repeat procedure 2 a, b, and c until the liquid reaches the top of the meter stick or until you have removed about 250 ml of air, whichever happens first.
3. Using different liquids, repeat procedures 1 and 2.

Summary

1. Graph your data. Include the data for all the different liquids on one graph. Identify the plotted points of each liquid with a different symbol. For each liquid, draw a curve or line through the points for that liquid.
   a. For every 10 cm that water rises in the tube, how much does each of the other liquids rise?
   b. What properties of liquids might explain these results?
2. Compare the operations of the Torricelli tubes used in Figures 27–1 and 27–2 with those in x23: A Torricelli Tube and a Fountain.
   a. How are the operations similar? How are they different?
   b. What is your hypothesis to explain how a Torricelli tube operates?
   c. Refer to your observations of a fountain in x23: A Torricelli Tube and a Fountain. What is your hypothesis to explain how fluids are moved in a fountain?

Challenge

1. Suppose that a Torricelli tube is 50 m tall. In the open air what is the greatest height to which mercury can be raised in the tube using an evacuation tube?
2. An instrument used to measure the pressure on any fluid is called a manometer. The special term, barometer, refers to an instrument that can measure air pressure. Design and construct a barometer to measure air pressure.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Lake Carlos Environmental Center Curriculum

STATED GOAL:

To develop awareness and appreciation for personal environments; through natural, social, valuing and action contexts; to provide an education in the principles of ecology, natural history, and outdoor skills through an interdisciplinary approach; to encourage responsible stewardship of the earth; to promote a sense of wonder toward the natural environment; and to help develop a greater sense of self worth and quality of life.

FORMAT:

Eight typed studies containing activities for 1-2 hour class sessions covering the following topics: Bird Study, Canoeing, Discovery Hike, Ecology Games, Land Stewardship, Nature Trail, Tree Study, and Wildlife Signs & Habitats.

AVAILABILITY:

Order from:
Lake Carlos Environmental Center
Route 5 West Lake Carlos
Alexandria, MN 56308
(612)846-2431

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Each study has been designed to address each context with primary emphasis on natural and valuing contexts.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Language, Art, Social Science

Planning the Program

Each program and schedule are planned by the school with the assistance of Lake Carlos Environmental staff to meet the specific needs of students. Some general comments and a curriculum list are included for easy planning. For information on what to bring, permission forms, and sample schedules, please refer to either the day or residential trip section of this guide. All sample schedules and the curriculum are can be adapted to meet your needs, time frame, and interests. Please call the Center's Environmental Education Director if you have any questions.

CURRICULUM

The classes are in-depth studies and activities in natural history, ecology or outdoor skills. They are designed with the flexibility to fill one or two hour sessions. The classes were developed for group sizes of 10 to 16 students. It is best to schedule several different classes to keep class size small. The groups rotate to the various class areas while instructors remain the same. Two types of classes are available: teacher/leader led and naturalist led.

Teacher/ Leader Led

The following section list classes that the Center can effectively and efficiently prepare teachers and group leaders to lead while on site. These courses are also available to be led by the Center's naturalist which may be desirable for small, day only or first time groups.

Bird Study- Learn to indentify the area's common birds and where they live and why.

Canoeing- Practice the basics on Lake Carlos. The instructor needs to be experienced. (subject to cancellation during bad weather)

Discovery Hike- Grow closer to nature by using all five senses to explore the natural world.

Ecology Games- Explore the dynamics of natural relationships through exciting outdoor games.

Land Stewardship- Develop a deeper sense of stewardship for the land. Study the soils' physical and biological aspects, and discuss soil importance, social problems and soil conservation.

Nature Trail- Hike a maple-basswood forest trail, and learn some natural history and other tidbits by stopping at interest points along the way.

Tree Study- Practice identifying and learn some past and present uses for trees and shrubs common to the area.

Wildlife Signs and Habitats- Identify animals by the clues they leave behind and discover the four things every animal needs to survive.

Snow Study- Learn the scientific properties of snow by measuring changes in temperature and studying drifts.

Survival- Through a simulated survival senario, prepare for the unexpected.

Naturalist Led

The following courses can be taught by the Center's naturalist. The naturalist can lead only one class per day. If any teacher wishes to create curriculum for the classes listed below, the naturalist would kindly assist.

Creative Expression- Develop a deeper appreciation for the natural world by expressing reactions to nature through a variety of games, activities and writings.

Pond Ecology- Explore the wildlife of a pond and marsh habitat and discover why this is an essential and endangered habitat.

Orienteering- Learn how to use a compass and practice on a course through the woods.

Geology- Minnesota's unique landscape is the result of sedimentation, glaciation, igneous and metamorphic processes which formed rich soils for praire grasses and a good habitat for wildlife.

RECREATION IDEAS

Canoeing	Field sports:
Hiking	Softball, kickball etc.
Initiative Games	Volleyball
New Games	Tennis
Snowshoeing (winter)	Cross-country skiing
Innertubing (winter)	Scavenger Hunt

EQUIPMENT

Besides the equipment needs for classes the following equipment is available for your use. Please notify us of any needs prior to the trip.

Audio Visual	Recreation
16 mm projector	canoes
film strip projector	paddles
movie screens	life jackets
stereo	cook kits
sound system	tents
cassette player	basketball, soccer
slide projector	volleyball, softball,
blackboard	tennis, badminton
VCR - TV	foosball, ping-pong

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

The Lake Superior Game: Use Vs. Abuse

STATED GOAL:

To have students develop a better awareness of the complex economic decisions faced by polluters of Lake Superior and experience decisions related to pollution, values, and economics in a dynamic setting.

FORMAT:

Students assume roles of individuals who use Lake Superior and make action choices appropriate to those roles. In this simulation a bucket of water that represents Lake Superior gradually becomes polluted and depleted as students follow through on their decisions.

AVAILABILITY:

Minnesota Sea Grant Extension Program
208 Washburn Hall
University of Minnesota
Duluth, MN 55812
(218)726-8106

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Social Science, Geography

- Play money, or a substitute, for roles that involve paying instead of polluting;
- At least four fish made to stand on the bottom of the lake (see number three below). Place three fish in the bucket before beginning the game;
- A fishing pole to catch the fish;
- A piece of plexiglass or plastic with the word "shipwreck" on it;
- A Secchi disk for estimating water clarity (see number four below).

3. Silhouettes of fish may be cut from a plastic coffee can lid or plexiglass and inserted into a slit in another piece of plastic that serves as a base (Figure 1). The base may have to be weighted to allow the fish to "stand" on the bottom of the lake. The use of red plastic or clear plastic edged with an indelible red marker makes it more difficult to see the fish once the water becomes polluted. Each fish should have a hole in its back so it can be easily hooked. The fishing pole can be constructed from a short length of cord tied to a dowel, with a bent paper clip as a hook.

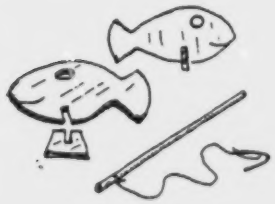

Figure 1.

4. A Secchi disk is a simple tool used to determine water clarity (transparency). The depth to which a Secchi disk is visible is directly related to the transparency of the water in a lake. For this game a Secchi disk can be cut from a white plastic coffee can lid. It should be a circle about 5 cm in diameter with a cord threaded through the center. (When used for scientific studies, Secchi disks normally measure 20 cm in diameter). The disk should be divided into four equal pie-shaped sections. Two opposite sections should be colored black with an indelible marker and two should be left white (Figure 2). The disk will have to be weighted so that it sinks when lowered into the bucket.

5. Prepare cards explaining individual roles, choices, and actions. Cards should be durable, with text large enough for students to read easily. The 32 roles included in this activity may be cut out and pasted onto tagboard.

6. If you are using play money that students use to "pay" for cleaning up their pollution, you should clip it to the appropriate cards before handing them out.

7. Arrange some method of assigning the order in which students will play. It could be done alphabetically or by handing out numbers. Do not use the order given here.

Figure 2.

Preparatory Activity

Before playing the game, hand out a map of Lake Superior and its drainage basin, accompanied by a worksheet.

1. Orient the students to the map by locating Duluth and Minnesota, Wisconsin, Michigan, and Ontario. Explain that all water within the watershed boundary (theoretically) drains into Lake Superior.

Mention other sources or reservoirs of water within the watershed, such as lakes, streams, wetlands, and groundwater. Stress that the reservoirs of water are interconnected: pollution of upstream inland lakes and rivers eventually affects Lake Superior. Include other "fact" or geographic questions about Lake Superior if desired.

MINNESOTA SEA GRANT EXTENSION
LACUSTRINE LESSONS
University of Minnesota
Aquatic Topics for Grades K-12
SUMMER 1988

LAKE SUPERIOR: USE IT, DON'T ABUSE IT

It Is a Superior Lake

Lake Superior and the other four Great Lakes represent America's fourth coast. The size of the lakes and the resources associated with them make the Great Lakes an ecosystem that is vital to the economy and quality of life in the United States. Among the Great Lakes, Lake Superior stands out as unique. The problems and opportunities associated with Lake Superior reflect the magnitude of its size.

Lake Superior is about 350 miles long and 160 miles wide. It is bordered by the states of Minnesota, Michigan, and Wisconsin, and the Canadian province of Ontario. Because it lies at the headwaters of the Great Lakes and is the terminus of the St. Lawrence Seaway, Lake Superior is of critical concern to Americans and Canadians alike.

The Great Lakes are huge. Together they represent about twenty percent of the fresh water available on the surface of the earth. Lake Superior is the largest of the lakes, containing about half of their total volume. In surface area, Lake Superior is the largest fresh-water lake in the world. It covers 31,280 square miles, roughly the area of Massachusetts, Connecticut, Rhode Island, Vermont, and New Hampshire.

In addition to being the largest of the Great Lakes in surface area, with a maximum depth of 1,333 feet Superior is also the deepest. Lake Superior has an average depth of 489 feet and contains nearly three quadrillion gallons of water.

Lake Superior is valued for transportation. Ships are the most cost-effective way of moving bulky and/or heavy cargoes over long distances. Major commodities moving across Lake Superior include grain and other agricultural products, western coal, iron ore, steel, limestone, and cement. Maintaining adequate water levels is important to shipping. Unfortunately, optimal water levels for shipping may cause coastal erosion.

The water of Lake Superior is important for power generation, manufacturing, and mineral processing. Although much water is withdrawn each year for these uses, only a small amount (about 21,134 million gallons) is consumed (not returned to the lake). Compared to the amounts consumed from other Great Lakes, this is nearly insignificant. Water consumption has not traditionally been a concern for the Great Lakes, but a 1983 report from the International Joint Commission concluded that, if present trends

BEST COPY AVAILABLE

SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Learning Excursions, Foreign Language Packets, and Concept Packets

STATED GOAL:

The curriculum units emphasize generalized concepts for each grade level that can be used at school and throughout the Zoo at a number of exhibits.

FORMAT:

The curriculum packets are extensive animal units 20-30 pages long. They include concepts and objectives, instructional activities for classroom use, vocabulary lists, and bibliography.
LEARNING EXCURSIONS: Packets include a unit of choice, poster, and a filmstrip for Minnesota Learning Excursions or a Zoo Guide and Zoobook for Tropics and Northern Trail Learning Excursions. Please indicate the correct age group and area of interest. Teachers who have registered for a guided Learning Excursion tour will be sent a unit, free of charge, in advance of their field trip. Packets available: Exploring Minnesota K-3, 4-6, 7-12; Visiting the Tropics K-3, 4-6, 7-12; The Northern Trail 4-6.
FOREIGN LANGUAGE PACKETS: Packets include a selected language unit, poster, and filmstrip. If you have registered to attend one of the Foreign Language Days at the Zoo this year, a unit of choice will be sent to you in advance of your field trip at no cost. Packets available: German, French, Spanish.
CONCEPT PACKETS: Packets include unit of choice, poster, Zoo Guide and book. Packets available: Animal Homes, Preschool; Locomotion K-2; Animal Cover Ups, 1-3; Vanishing Animals, 4-6; Camouflage, 4-6; Habitats, 7-9; Animal Conservation, 10-12.

AVAILABILITY:

Price of $14.95 per packet includes state tax, postage, and handling. Additional units cost $5.00 each. Allow 3-4 weeks for delivery. Order from:

ZOO STORE
Minnesota Zoo
Apple Valley, MN 55124
(612)431-9319

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

- The main thrust of these units is in the natural context but also includes the social and valuing.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science

DAILY PROGRAMS

Orientations -
We welcome your school group to the Zoo with a brief introductory program shown upon your arrival. Volunteers will provide school groups with a schedule of the events happening on that day, directional guidance, animal information and the rules of the Zoo. This program is required for all school groups scheduled through the School Program.

Zoolab -
Here's a chance to touch a boa constrictor, a tarantula or an armadillo. Zoolab is a special room where students can meet a variety of animals up-close, with the help of a volunteer. Open by reservation only, school groups can schedule a twenty minute visit in Zoolab between the hours of 10:00 a.m. - 12:00 p.m. and 1:00 p.m. - 3:00 p.m. Scheduled times are arranged through the Scheduler when you make your trip reservations.

Skytrail -
Meet Minnesota's seasons in comfort when you schedule a ride on the elevated monorail train - Skytrail. You will view animals found in natural ecological settings of the prairie, steppe, tundra and taiga. An interpretive guide provides a personal natural history narrative from a perspective you may not be able to experience otherwise.

A Northern Trail Learning Excursion unit can be ordered to accompany the Skytrail trip. The unit provides teachers with pre-visit and Zoo field trip activity sheets on animals found on the Northern Trail and seen from the train. SEE ORDER BLANK on page 9.

Skytrail operates all year. Discount group rates of $1 per student or chaperone are available to organized school groups when scheduled at the time arrangements are made for your field trip. In addition, September through May, specific Skytrail departure times must be scheduled for your group. June through August, Skytrail trips are on a first-come, first-served basis.

Animal Demonstrations -
Provided daily for all Zoo visitors. Volunteers bring ferrets, snakes, prairie dogs, and lizards to the center of attention captivating audiences with the fascinating world of animals. Animal demonstrations can be observed daily. Check with the volunteer during your orientation to confirm the times and location of the demonstrations.

Children's Zoo -
Feed a Nubian goat, touch a rabbit, see a magnificently antlered reindeer and a shaggy yak up close! At the Children's Zoo, kids of all ages develop a closeness with a variety of exotic domestic animals. It is open year round.

The "World of Birds Show "-
This natural free flight bird show provides an exciting opportunity to witness the behaviors of several birds in shows at 11:30 a.m. and 1:30 p.m. every day but Mondays. See avian aerial acrobatics, parrot mimicry and the delightful antics of some amazing birds. Learn about the natural history and the environmental concerns for these beautiful birds. Check with the volunteer upon your arrival for the location of these shows.

Lunch Options-
Indoor eating and lunch storage facilities at the Minnesota Zoo are not provided for school groups. We ask that you eat on your bus. A beautiful picnic area with a shelter is available for fall, spring, and summer field trips. Located near the entrance of the Zoo, tables are available to meet the needs of your class. No reservations for the picnic area are necessary. Dairy Queen offers a full line of fast food and seating is available for their customers. For a $25 fee, your group may rent the Moose Lodge for lunch. Reservations for the Moose Lodge must be made in advance.

Housing/Overnight Accomodations -
Have you come a long way? The Minnesota Zoo is located near some truly beautiful campgrounds where you and your class can enjoy a rustic overnight. You can find out about nearby camping facilities by contacting the Dakota County Parks Board at (612) 437-6608 or the Hennepin County Parks Board at (612) 559-9000. Listed below are some campgrounds which may be able to provide accomodations for your group:

- Lebanon Hills, Apple Valley, MN (612) 437-6608
- Wilder Forest, Marine on St. Croix, MN (612) 433-5198
- Camp St. Croix, Hudson, WI (612) 436-8428
- Silver Lake Camp, Minneapolis, MN (612) 788-9048

Asian Yak

SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Managing Our Natural Resources

STATED GOAL:

To provide comprehensive, up-to-date coverage of every facet of natural resource management including: soils, water, game, and energy. The text presents the background of various conservation issues and relates them to the present day. A short history of natural resource management is also included.

FORMAT:

300 pp., 8 x 9-1/9, hardcover, 1988. Contains 31 chapters and a glossary of key terms. Each chapter includes: performance objectives, "Terms-To-Look-For", summary, review questions, and suggested activities, plus a careers section giving students an in-depth look at a wide range of possibilities. Sensitive issues (ie., nuclear power) are handled objectively, and student activities deal with issues in students' communities.

AVAILABILITY:

For additional information and/or to place an order, contact:
Customer Service Department
Delmar Publishers, Inc.
Two Computer Drive West
Box 15015
Albany, NY 12212
1-800-347-7707
Fax: 518-459-3552

Note: All prices are tentative and subject to change without notice.

Text	Order #2756-0	$20.95 List/$18.00 Net
Instructor's Guide	Order #2757-9	$ 8.00 List/$ 6.00 Net

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Social Science, Agriculture, and Forestry

18

Fire!

OBJECTIVES

After reading this chapter, you will be able to

- list and describe some of the most destructive forest fires in United States history
- draw and explain the fire triangle
- explain how fire can be used as a positive tool in woodland management
- describe the anatomy of a typical forest wildfire
- explain how fire fighters find and attack a forest wildfire

TERMS TO LOOK FOR AND LEARN

PESHTIGO FIRE
FIRE TRIANGLE
IGNITION TEMPERATURE
INCENDIARY WILDFIRE
GROUND FIRE
SURFACE FIRE
CROWN FIRE
TRIANGULATION
ALIDADE
MIRAMICHI FIRE
FIRE SUPPRESSION
FIRE BARRIER
BACKFIRE
PRESCRIBED FIRE

The camera sweeps across a burned hillside. Smoke seeps upward from still-smoldering tree trunks. A small animal killed by the fire lies on the ground. A deep voice reminds, "Remember, only you can prevent forest fires." Smokey the Bear, the Keep America Green programs, and other efforts aimed at forest fire prevention are familiar to most Americans. Television commercials, radio announcements, comic books, highway billboards, and other things aimed at forest-fire prevention have been around since World War II.

The original Smokey bear was actually a survivor of a forest fire. Badly burned by a wildfire, the bear was rescued, nursed back to health, and moved to the National Zoo in Washington, D.C. There, Smokey remained a living symbol for many years. At his death, he was replaced by another bear, who carried on the tradition.

Nobody knows how many acres and lives have been saved because of these education programs, but, since they began in the 1940s, the number of wildfires reported each year has dropped dramatically. Before 1950, forest fires were reported at the rate of about 500 per day in this country. In the 1960s and 1970s, this rate dropped to about 300 to 400 per day. That is still high, but the rate is, at least, better now.

or helicopters are used to dump water or chemical fire retardent directly onto the fire.

A narrow fire lane can be cut just ahead of the fire. This is done with a shovel, rake, hoe, mattock, axe, or other hand tool. It involves removing all combustible materials down to bare soil in a narrow strip around the fire. The fire burns up to the fire lane and burns itself out. The fire fighters must insure that sparks do not jump across the lane and start fresh fires.

Indirect Attack

An indirect attack on a wildfire involves removing fuel from the fire triangle. There are basically two techniques: barriers and backfires.

A *fire barrier* may be any road, stream, bare area, field, lake, or other natural obstacle to the fire. Natural or existing barriers, if any, are coupled with hastily constructed barriers. Bulldozers and special plows are used to clear fire lanes or firebreaks ahead of the fire. Chainsaws or other saws are used to remove trees that could fall across the barriers.

Barriers are normally constructed or completed first in front of the head of the fire because the fire spreads most quickly in that direction. Once the barriers are complete across the head of the fire, they are extended around its flanks and, finally, its rear. Of course, if homes or businesses were threatened by the flanks or rear, they might be protected first. But normally the head is attacked first, then the flanks, then the rear.

Once a barrier is complete along the head, the decision must be made as to whether to use *backfire*. If the fire is spreading quickly, if the wind is fairly strong, or if the fire is fairly large, it may jump across the narrow fire lanes. Backfire can be used to greatly widen the fire lane.

Remember that a fire spreads most slowly toward the wind. The head of the fire is moving away from the wind and toward the firebreaks. Backfires are smaller fires set along the firebreak on the side toward the fire. They slowly burn toward the wind and the wildfire. As they burn, they use up the fuel. Thus, in effect they make the firebreaks wider. This removes the fuel from the head of the fire, which then must go out (see figure 18-6).

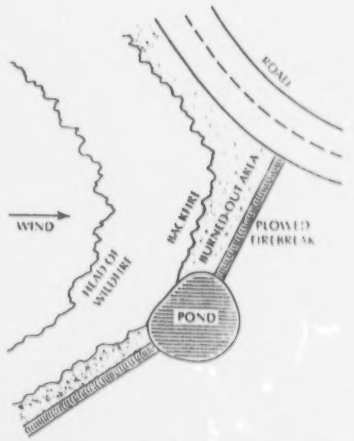

FIGURE 18-6
Backfires and firebreaks are combined to stop a forest wildfire. The burned-out area no longer has fuel.

Backfires, in most situations, are set by fire fighters on foot, but in the last few years, aerial backfiring techniques have been developed using a spontaneously igniting chemical combination (potassium permanganate and ethylene glycol) in small, plastic balls like Ping-Pong balls.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Marine Science Project: For Sea (Grades 7-8 and 9-12)

STATED GOAL:

Comprehensive, activity-oriented marine science curriculm which teaches basic science skills and knowledge on or away from coast

FORMAT:

Student text and activity sheet; teacher background information; answer keys; bibliography of additional material

AVAILABILITY:

Eight hours of training required before ordering material. Materials $35.00 per grade level curriculum guide. Available from:

Genelle Bentley
N & C MN Reg. State Facilitator
HCR 3, Box 15
Staples, MN 56479
(218)894-1930

-or-

Gail Goltz
SW & WC ECSU
SW State University
Marshall, MN 56258
(507)537-1481

-or-

Diane Lassman
116 University Press Building
2037 University Ave. SE
Minneapolis, MN 55414-3092
(612)624-0584

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH AREAS CAN IT BE INTEGRATED?

Science

The Marine Science Project
What it is and what it does.

Planet earth might be better called planet water. Over seventy percent of the earth's surface is covered by seas. The history of the United States is tied to the seas. Today, over half of all Americans live within an hour's drive of the sea or Great Lakes coasts. By the year 2000, three out of four Americans will live in these coastal strips. The impact on the coastal waters will be severe. The curriculum materials developed by the Marine Science Project: FOR SEA are designed to create "marine literate students", students who will grow into adults equipped with the information necessary to make the scientifically correct choices necessary to protect and maintain the world of water.

The Marine Science Project: FOR SEA has addressed the nationally recognized need for quality marine education materials. Elementary and secondary students need information about the marine environment in order to prepare them to make ecologically sound decisions regarding the future uses of the oceans. Recognizing these needs, the Marine Science Project: FOR SEA developed comprehensive, activity oriented marine education curricula for second, fourth and sixth grades, and for junior high and high school levels. Each curriculum guide contains:

- a conceptual framework
- complete student texts and activity sheets
- complete teacher background information for each activity
- a bibliography of children's literature of the sea (elementary guides)
- a bibliography of children's information books of the sea (elementary guides)
- a bibliography of selected books about the marine environment (secondary guides)
- answer keys and a list of key words for each student activity
- a guide to marine aquaria

Curriculum packages containing the curriculum guide, pre and post tests, class sets of student text and activity pages, and an activity kit containing the materials required are also available.

The Marine Science Project: FOR SEA materials work because they are presented in a format designed to develop the scientific attitude which demands accuracy, intellectual honesty, open-mindedness, organization, curiosity, and responsibility. The materials stress skills designed to increase the students' command of reading, simple computation and oral and written expression while at the same time fostering a respect for the dignity and worth of the individual.

But do the project materials work?

Marine Science Project: FOR SEA materials have been extensively evaluated using a traditional pre-test post-test design with experimental and control groups. Teachers of experimental groups received inservice instruction which included: overview of the project, test administration procedures, and activities designed to familiarize teachers with the materials. The experimental groups received instruction in marine science from their classroom teachers using project developed materials. An analysis of test data indicates that students using Marine Science Project: FOR SEA materials showed significant gains in their knowledge of marine science when compared to control groups on both project developed tests and on the nationally recognized CTB McGraw-Hill Comprehensive Test of Basic Skills: Science Tests. These significant gains obtained in widely different geographic regions and a wide variety of classrooms under a wide variety of teaching situations.

What do the students have to say about this program?
"I will remember almost everything I learned about Marine Science" . . . "We had a good time doing it!" . . . "I hope we get enough money to get a big aquarium before the end of the year so us sixth graders can use it" (the class did raise enough money to do just that) . . . "It was fun because I got to run the experiment with my friend".

The test results show that not only was it a good experience, it was a significant learning experience as well.

What do the teachers have to say about this program?
"Excellent!" . . . "This is the *first* time I've had 'hands on' materials" . . . "I would enjoy teaching it again next year" . . . "They did learn a lot. I did too!" . . . "Your program has really united this staff" . . . "I'm working on the school board to adopt the program" . . . "The parents were so excited when we talked during the parent teacher conferences" . . . "With this class, the only time I really feel like I have them in the palm of my hand is when we're doing Marine Science" . . . "I always dreaded when the poor readers volunteered to read science out loud. But they could read this! It was great!"

A good experience for both teachers and students.

About the Project . . .

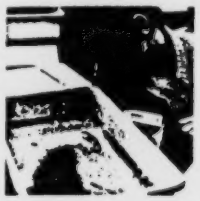
Developed under an Elementary and Secondary Education Act, Title IV-C grant from the State Department of Education in Washington, the Marine Science Project: FOR SEA has its origins in the materials used at the Marine Science Center in Poulsbo, Washington. The Center, administered by Educational Service District 114 of Port Townsend, Washington, is a unique facility dedicated to marine science education. Dissemination of the Marine Science Project is funded through a National Diffusion Network grant from the U.S. Department of Education providing financial aid to interested districts, schools and teachers.

The work of the Marine Science Center falls into three basic areas:

The first is to prepare curriculum materials. That means developing new programs such as the Marine Science Project: FOR SEA materials. That also means enriching existing science programs in all school grades from kindergarten through high school. Through this work we help the cause of science education generally, and marine science education specifically.

The second major job is to teach. We have everything it takes to do that: laboratories, classroom space, faculty and administrative staff, and facilities. Our dock side building includes a research laboratory, both wet and dry labs with a complex of specimen tanks and circulating sea water. The Center is an interesting, exciting place to learn.

And the third job is to serve as a resource center. We're at places like school districts and teachers conferences to get many kinds of teaching aids, from audio-visual and printed materials to live specimens. We also provide training for teachers, and develop special programs for special students. We make you welcome to inquire about our services.



Project materials were tested and revised using input from classroom teachers. The success of the project materials is reflected in the state validation of the project materials and the national validation of the elementary materials by the Joint Dissemination Review Panel of the National Diffusion Network. Our secondary materials are now undergoing the same strenuous national validation process.

We'd like to share our materials with you.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

National Wildlife Week Teacher's Kit

STATED GOAL:

To provide a source of environmental education activities for teachers.

FORMAT:

A yearly packet of information on a specific topic including posters, student activities, teacher information, and a sheet of topic stamps. Topics change each year.

AVAILABILITY:

Free: Published annually in early winter. Order from:
Minnesota Conservation Federation
1036B Cleveland Ave. South
St. Paul, MN 55116
Att: Duane Lund
(612)690-3077

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Social Science, Music

3 PEOPLE AND PREDATORS

Hikers in Denali National Park in Alaska round a bend and catch a glimpse of a grizzly fishing in a clear mountain stream. In a Pennsylvania backyard, a homeowner releases a preying mantis, hoping to get rid of a few garden pests. In a Florida neighborhood, wildlife officers capture a nuisance alligator and return it to a nearby swamp. And off the Pacific coast, a group of swimmers head for the beach when someone screams, "Shark!" From coast to coast and around the world, people and predators interact in hundreds of ways every day.

PREDATOR PERSPECTIVES

People/predator interactions are nothing new—they've been happening since the dawn of the human species. And over the course of time, our interactions have forced us into a love-hate relationship with these animals. On one hand, many people respect and value these hunters that are so powerful, so graceful, and so beautiful. Many cultures have even worshipped them as gods. But on the other hand, some people fear and mistrust predators and even view them with contempt.

Our earliest ancestors hunted to survive, competing with the other predators they shared the planet with. It's hard to know for sure how these early humans felt about predators, but they almost certainly feared them—especially the cats, bears, wolves, and other predators that were stronger than they were.

When people started domesticating animals and growing crops, a new type of competition emerged. As more land was used for crops and grazing, less land—and fewer natural prey—was available to wild predators. As a result, predators began to attack cattle, sheep, chickens, and goats to get the food they needed to survive. And even when natural prey was available, it was often easier for wild predators to kill domesticated animals than it was for them to catch wild ones. Over time, predators were labeled "bad guys" and "murderers." Even fairy tales became saturated with "cunning" foxes, "bloodthirsty" wolves, and other negative images.

PROBLEMS FOR PREDATORS

Many people dealt with their fear and mistrust of predators by trying to get rid of them. And government officials, from Greek rulers to English kings, put bounties into effect, giving citizens financial incentives to exterminate predators.

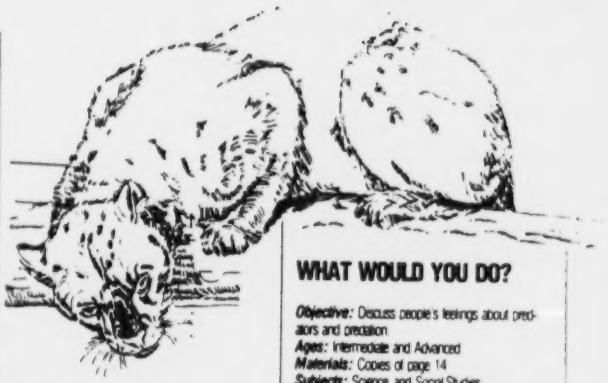
This tradition continued in North America where, in the 1630s, the first bounties were paid for wolves. And as settlers moved west, they not only killed wolves, but also cats, bears, and many birds of prey. They also cleared and fenced in thousands of acres for ranches and farms—forcing predators to live on smaller and smaller parcels of wild land.

As ranches spread across the West, cattle and sheep ranchers and others stepped up the battle to eliminate predators. By the early 1900s, they had successfully lobbied the federal government to support a predator control program, and many states reinforced the policy with their own anti-predator legislation. During the years that followed, thousands of wolves, bobcats, eagles, foxes, hawks, coyotes, and other predators were shot, trapped, and poisoned. The result was far-reaching. Cougars, which had already been eliminated in the East, became less common in the West; red wolves disappeared from the South and Southwest; grizzlies, which once roamed the entire West, remained only in Montana, Wyoming, and Idaho; and gray wolves disappeared from all states except Alaska, Minnesota, and Michigan.

WHAT ROLES DO PREDATORS PLAY?

Even while the predator control programs were in full swing, many people were becoming concerned about the survival of predators. As early as the 1920s, biologists began to study natural communities to find out just what role predators play. Some studies showed that predators do, in fact, help regulate prey populations. But in other cases, they appeared to play only a minor role, overshadowed by the roles of habitat changes, disease, extreme weather conditions, and lack of food or water. Some studies also showed that predators sometimes cull out the most vulnerable prey—the very old, very young, and very sick—leaving more food for healthy prey animals and slowing down the spread of disease. But many of the studies showed that predators also catch healthy prey when they can. Together, all of the studies point to the fact that predators *are* important, and that the role they play varies from community to community and from season to season.

In the past two decades, public attitudes about predators have changed dramatically. Although predators are still controlled or killed in some states, most areas carefully regulate the taking of large predators such as wolves, cougars, bobcats, and bears. A number of federal laws, most inclusively the Endangered Species Act, have helped protect many predators and other animals. But even with federal protection, many predators—including grizzlies, wolves, and cats—are having a tough time surviving in our increasingly urbanized world.



BACK INTO THE PICTURE

As problems for predators increase, more and more people are beginning to see predators as they really are: *not* cruel, vicious murderers, but animals that play an important role in natural communities and that are equipped with amazing adaptations for catching prey. Many people also feel that predators add a special beauty and spirit to wild places.

These changing attitudes have resulted in some exciting projects designed to put predators back into areas where they once lived. For example, captive-bred red wolves have been released in the Alligator River National Wildlife Refuge in North Carolina, and peregrine falcons have been released into many parts of the country, including Denver, Baltimore, and other cities. Biologists are also planning to reintroduce gray wolves into Yellowstone National Park, a place where they once thrived. All of these efforts reflect an increasing understanding of predators and a growing commitment to make sure wild predators always remain a part of the picture.

WHAT WOULD YOU DO?

Objective: Discuss people's feelings about predators and predation.
Ages: Intermediate and Advanced
Materials: Copies of page 14
Subjects: Science and Social Studies

In this activity your group can explore how they feel about predators. To start, pass out copies of the scenarios printed on page 14. Then have the kids read each scenario and choose the option that best describes how they would react if faced with each situation. Explain that if none of the options apply, the kids should jot down other actions they would take.

When the kids are finished, have them share their reactions. (You might want to keep a tally where everyone can see it.) Ask them what kinds of things they kept in mind as they made their decisions. For example, did they choose what they thought were the most responsible actions to take? Did they think about laws that might affect the situation? Did they need more information before they felt comfortable making a decision?

After your discussion, have the kids read each scenario again. Then ask if the group discussion helped provide new perspectives or if, after listening to other people's opinions, any of the group members had changed their mind about what they might do.

(continued next page)

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Oscar's Options

STATED GOAL:

Written for grades 4-8. These two books present activities to educate students on solid waste management.

FORMAT:

Activities with listed objectives integrated into math, reading, creative writing, and art. Teacher pages with background information included.

AVAILABILITY:

Prepared by Rhode Island Department of Education. Available free from:

Waste Education Coalition Clearinghouse
Minnesota Waste Management Board
Sue Thomas, Waste Education Planner
1350 Energy Lane
St. Paul, MN 55108
(612)649-5483

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Social Science

NINETY-TWO POUNDS OF TROUBLE

Plastics have changed our way of life. Each year, items once available in glass or paper appear in new plastic packaging. Is this good news or bad?

The good news is that plastic really does have a lot of advantages. It is flexible and strong. It won't break when you drop the bottle with soapy hands. It can be shaped and colored in many different ways. The cost to manufacture it is fairly low.

What, then, is the bad news? As of 1986, Americans were throwing away 92 pounds of plastic per person each year! That means that the raw materials and the energy needed to make the plastics are wasted. Since plastic is permanent, it will stay in a landfill forever.

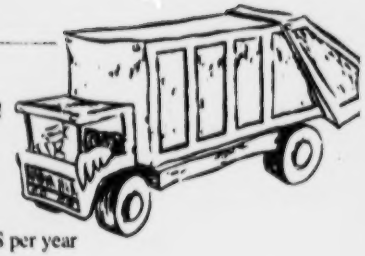
What should we do? Here are four possible answers: ban, biodegrade, bury and burn. But banning plastic won't work. We like its convenience. Very few plastics now made will biodegrade. To bury the plastic in a landfill takes up too much space. Some people think that burning plastics in an incinerator is the best idea. Plastics do help all the other types of solid waste to burn better. But, 60 - 90% of the energy used to make plastic is still lost. Also, the air released from burning may be harmful to our health.

As you may have guessed, recycling is the best ending to the life of a plastic bottle. There are many different kinds of plastic in use. Thus, there are some problems. Only plastics whose chemical makeup is the same can be recycled together. Milk bottles are made of a chemical known as HDPE. Soda bottles are formed from another plastic known as PET. The two plastics can't be mixed. Sorting and separating plastics first, and then recycling them makes sense. We can save energy, resources and money. More than $20 billion could be saved each year if we recycled all waste plastics.

Recycled bottles are compacted into bales, shredded into strips, or ground into small flakes. Then they are hauled away to be reformed. Such plastics are now used in fiberfill (for jackets, sleeping bags, and pillows), car seats, straps for movers, wall tile, toys, and scrub pads. Some plastics can be reformed into fiberglass tubs, showers, boat hulls and swimming pools. A new type of "plastic lumber" is now being used in some construction projects.

Using plastics may be a habit that's hard to break. We need to form the recycling habit as well. Then the cost, to our environment and ourselves, will be much less.

NAME_____



WORK IT OUT!

Remember: MSW = municipal solid waste
CSW = commercial solid waste
The figures in Table 1 are in TONS per year
One ton = 2000 pounds

1. Middletown, Newport and Portsmouth trucked their waste to Massachusetts in 1985. How much MSW is that?

2. How much CSW do these three cities produce?

3. The other towns whose solid waste does not go to the Central Landfill have their own town landfills. How many town landfills are there?

4. Total the MSW for the towns in #3.

5. Total the MSW for Cranston, Warwick and Providence.

6. Find the difference between the totals in #4 and #5.

   ***BONUS:** Explain why three cities create more trash than nine.

7. What three cities have the most CSW sent to the Central Landfill?

   ***BONUS:** Explain why Providence has so much CSW.

8. What five cities have more CSW than MSW?

9. Find the city with the smallest amount of TOTAL solid waste. How many POUNDS per year does it create?

   ***BONUS:** Why is this town's amount of solid waste so small?

10. Find the difference between Woonsocket's MSW and Coventry's.

SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Our Great Lakes Connection

STATED GOAL:

A K-8 interdisciplinary program designed to provide teachers and students with information about various aspects of the Great Lakes and numerous ways to become involved with them.

FORMAT:

A 205.page, 24 activity, three ring notebook punched series of activities, maps, charts, photos, etc.

AVAILABILITY:

Free by writing or calling:
Our Great Lakes Connection
1450 Linden Drive
UW-Madison
Madison, WI 53706
(612)262-1377

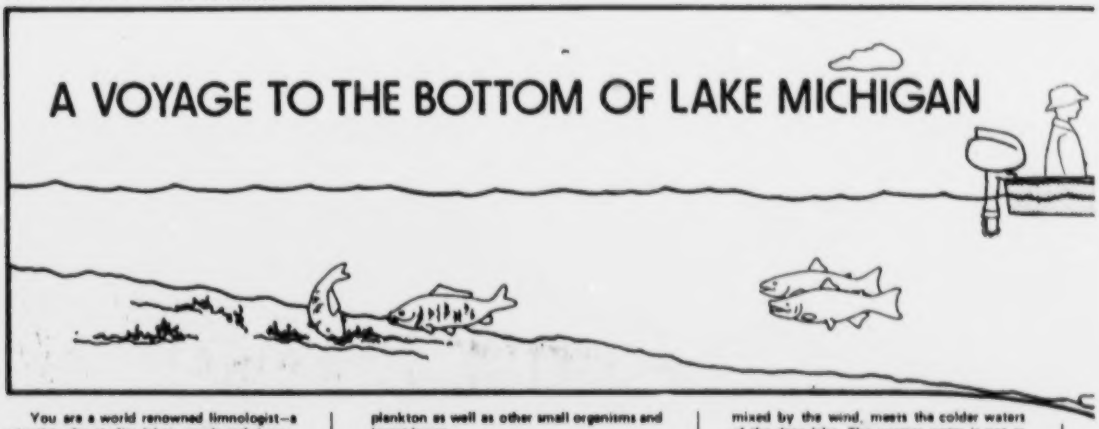
TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Bridges all four contexts with special emphasis on the natural and social.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Social Science, Language Arts, Fine Arts, Math

A VOYAGE TO THE BOTTOM OF LAKE MICHIGAN



You are a world renowned limnologist—a scientist who studies lakes, ponds and rivers—and you've been chosen to make a descent to the bottom of Lake Michigan. Your mission: to observe life in the lake at different depths. You will descend in a research submarine, complete with observation window, oxygen supply and scientific gear.

The day of the descent arrives. After answering reporters' questions on this cool, September morning, you climb aboard the glass-bottom boat that will speed you to the submarine awaiting you a few miles offshore. As the boat pulls out of the Milwaukee harbor, you look through the glass bottom and see several carp lurking on the bottom. Imported by European immigrant farmers as a food fish in the late 1800's, these large scavengers are despised by many fishermen and duck hunters. Carp browse on submerged vegetation, uprooting plants which ducks need for food, destroying cover for native fish and muddying the waters.

The whitefish has long been prized commercially for the quality of its meat. In 1836 one scientist wrote, "We can say from personal experience that a diet of whitefish alone, with no other food, can be eaten for days without losing its appeal." The fish still has appeal today. In 1976, over two million pounds of whitefish were harvested by Wisconsin fishermen using gill nets and pond nets. These went to restaurants and supermarkets throughout the country.

Near the shore you spot some large, reddish fish, not usually found so close to shore. These coho salmon are also coming in to spawn. Until recently, salmon did not exist at all in the lake. But in 1966, the state of Michigan began to stock the lake with Pacific salmon and now other states stock them in the lake as well. The salmon—coho, king and pink—were brought in to help keep problem fish under control and to provide excitement

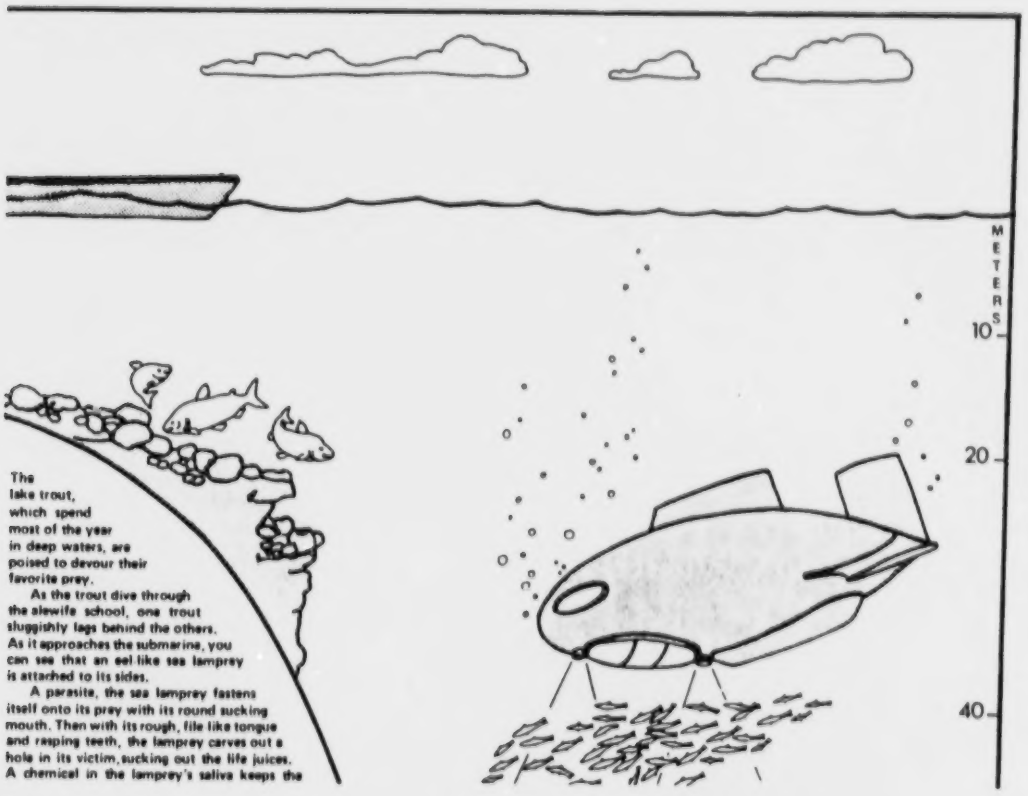
plankton as well as other small organisms and insect larvae.

mixed by the wind, meets the colder waters of the deep lake. The warmer water is not as heavy as the cold water and so lies like a blanket across the top of the lake in summer. As you drop below the thermocline, the temperature stabilizes at 4 degrees centigrade.

As winter approaches, this thermocline will disappear. The surface winds will cool the warm surface waters and help mix the two layers of water together until water at all depths is about the same temperature. This mixing also circulates nutrients from the lake bottom to the surface levels. These nutrients are critical to the growth of phytoplankton at the surface.

DEEP WATERS

In the dark, murky waters at 35 meters, arrow like flashes scatter around the research vessel. You are passing through a school of rainbow smelt. This shimmering fish has a greenish back and a silvery belly. Like many



The lake trout, which spend most of the year in deep waters, are poised to devour their favorite prey.

As the trout dive through the alewife school, one trout sluggishly lags behind the others. As it approaches the submarine, you can see that an eel like sea lamprey is attached to its sides.

A parasite, the sea lamprey fastens itself onto its prey with its round sucking mouth. Then with its rough, file like tongue and rasping teeth, the lamprey carves out a hole in its victim, sucking out the life juices. A chemical in the lamprey's saliva keeps the

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Project Learning Tree

STATED GOAL:

An interdisciplinary environmental education program that utilizes the forest as a "window" into the natural world.

FORMAT:

Two curriculum guides (K-6 and 7-12) containing over 175 environmental education activities and lessons for existing curricula plus an extensive compendium of supporting resources.

AVAILABILITY:

Available only through 6-hour experiential workshop participation. Workshop Fee, $5. Contact:

Laura Noy
Box 5
500 Lafayette Road
St. Paul, MN 55155
(612)297-2214

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH ENVIRONMENTAL AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Health, Social Science, Music

28

Cartoons and Headlines

SUBJECTS
Language Arts and Humanities
Journalism
Social Studies
Science

GRADES
7-9

PLT PRINCIPLES
3. Cultural Contexts
4. Societal Perspectives on Issues

CONCEPTS
3.42 Environmental Perspectives
3.421 Cultural Perceptions
4.12 Language As Influence Tool
4.13 Value-Loaded Language

SKILLS
V. Problem Solving
IV. Critical Thinking
II. Communication

OBJECTIVE

Students will write a humorous and unlikely headline about some phase of forest management and related issues and be able to give reasons why the headline is improbable.

ACTIVITY

Ask students to write "not-likely-to-happen-headlines" with an accompanying lead paragraph relating to the origin of some forest issue or use of some forest resource. Examples are:

Lumber Harvested in National Parks
Wilderness Organizations Want Grand Canyon For Landfill
Timber Interests Advocate Raising Home Interest Rates
Allowable Cut Can Exceed Growth Indefinitely, Says Genetic Expert
Decaying Organisms Unnecessary, Says Forest Ecologist

Discuss why each headline is unlikely. What conditions would have to occur before the headlines would be probable? Are any of these conditions likely to happen in the future?

VARIATION

Ask students to study editorial cartoons, and discuss their purpose and value as a form of communication. Then, ask the students to draw humorous cartoons about a local or national forest-related environmental issue such as land use, wilderness, or recycling. Students might also take existing cartoons and write new punch lines, then giving reasons why the circumstance or point of view is improbable.

RESOURCE

See "Teaching Environmental Education with a Focus on Values" by Clifford Knapp, *Journal of Environmental Education*, Summer 1972.

Wasted Words

29

SUBJECTS
Language Arts and Humanities
Journalism
Social Studies

GRADES
7-12

PLT PRINCIPLES
3. Cultural Contexts
4. Societal Perspectives on Issues

CONCEPTS
3.42 Environmental Perspectives
3.421 Cultural Perceptions
4.12 Language as Influence Tool
4.13 Value-Loaded Language

SKILL
II. Communication

OBJECTIVE

Students will be able to describe the advantages and disadvantages of using emotionally-loaded language when attempting to communicate effectively.

ACTIVITY

Many people, when hearing or talking about environmental issues, do not have an adequate understanding of the terminology used. A Gallup Poll taken in 1972 interviewed 388 people earning a minimum of $15,000 a year with backgrounds including some college education. Survey results showed that not one person interviewed could define correctly "climax forest," "tree farm," "sustained yield," "conservation," or "solid waste," and 35 percent of the group had no idea of the meaning of "clearcutting."

Another semantic complication is the tendency during heated debate to use words or phrases with connotative meanings which tend to obscure the real issues. The activities suggested here are designed to assist students to recognize and deal with such "loaded" words and phrases.

Ask each student to clip out and bring to class an editorial, newspaper story, or brief magazine article about a forest-related environmental issue. Next ask the students to choose from the examples all the words which carry highly emotional overtones – words such as "ravaged" and "plundered."

List all of these emotion-laden words on the blackboard. Divide your class into small groups of three or four students each and assign several of the words to each group. Ask each group to define its assigned words, both denotatively and connotatively as they were used in the example. You may wish to ask several groups to define some of the same words to get varying interpretations of their connotations.

After the definitions have been completed, share them in class and discuss questions such as these:

Which interpretation, the denotative or the connotative, lends more clarity to the message of the written editorial or article?
Clarify the difference between the accuracy of a message and its purpose.
How do you verify accuracy? What criteria might you use?
Which interpretation appears to more effectively convey the writer's message?
Does the use of words or phrases which evoke emotional responses obscure the issue involved? If so, how?
Do different sources and media have varying responsibilities to be accurate?

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Project Mayfly

STATED GOAL:

To provide educational study units which will allow high school students to monitor the health of streams, rivers, and lakes in their own area.

FORMAT:

Loose-leaf booklet of 100-plus pages with the following units: Water Chemistry; Biological Analysis; Bacteria, Algae, and Plankton in Water Quality; Streamwalking; and Field Trip. Teacher background and student activities included.

AVAILABILITY:

From:
National Audubon Society
Mid-Atlantic Regional Office
1104 Fernwood Ave. #300
Camp Hill, PA 17011
(717)763-4985
Cost:
$6.00

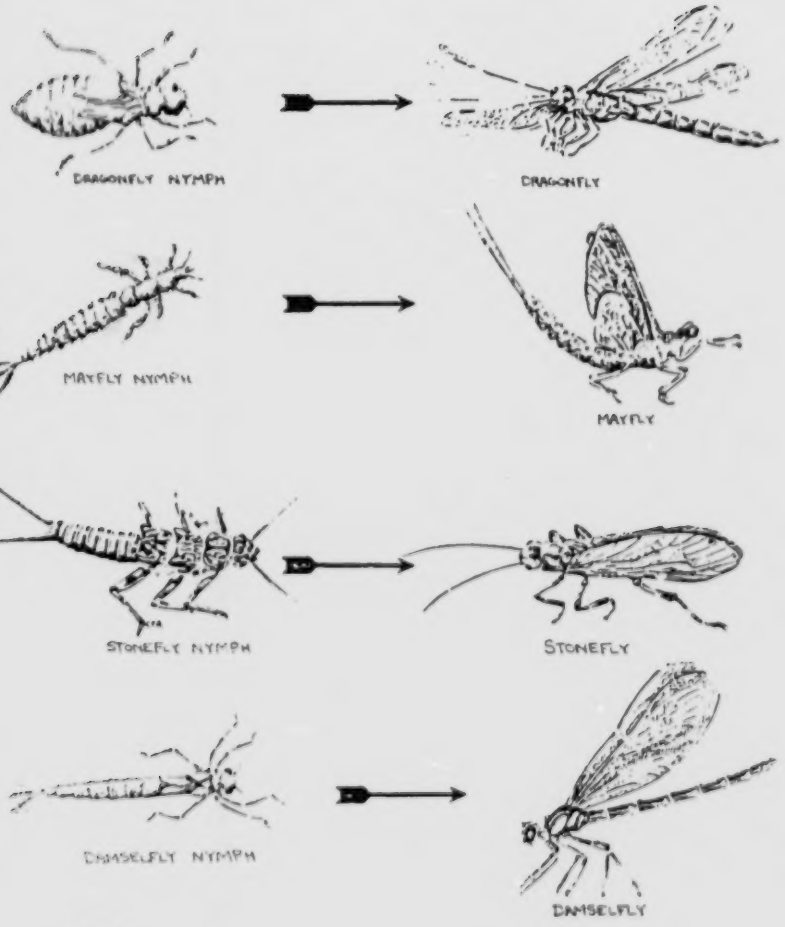
TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

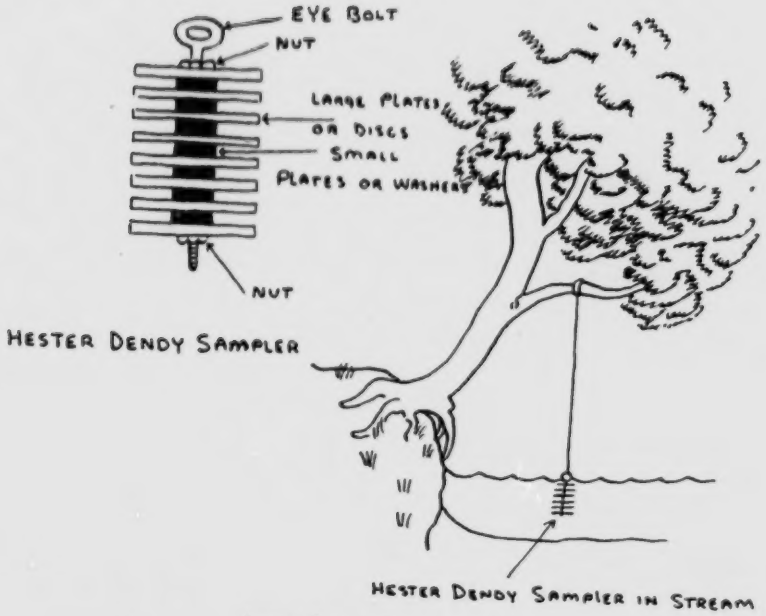
All contexts

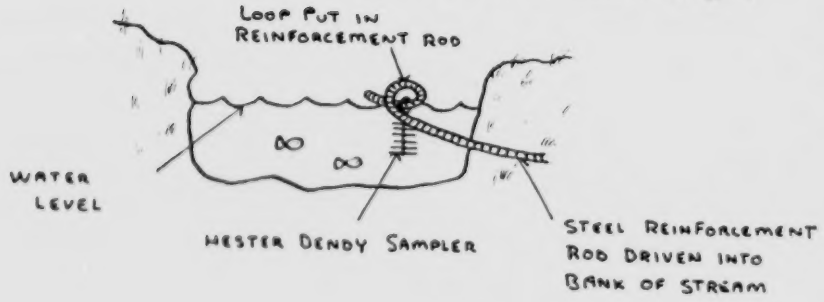
INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science

POND LIFE







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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Project Outlook on Groundwater, 3 books

STATED GOAL:

To learn about the phenomenom of ground water, mechanisms by which contamination may occur, and the effects of contamination on all forms of life

FORMAT:

Booklets containing: Title, Activity in Brief, Ojective, Site, Time, Materials, Exploration, Invention, Application, Teacher Notes, For the Teacher, For Your Information, Follow-up Activities, Resources

AVAILABILITY:

Contact: Dr. David McCalley
Institute for Environmental Education
Room 2251 McCollom Science Hall
University of Northern Iowa
Cedar Falls, IA 50614
(319)273-2581

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Health, Social Science

Contamination Rummy

Activity in Brief

Students play a card game related to point/nonpoint source pollution.

Objective
Students discover the difficulty of identifying nonpoint sources of pollution.

Site
Classroom

Suggested Time
1 class period

Materials
1 deck of Animal Rummy cards for every 5-7 students
set of labels (type that peel off easily once they have been attached)
marking pens

Exploration

Student groups will play Contamination Rummy, the point of which is to receive a low score. This score is obtained by counting the points of the cards each player holds when the game is over. Only the cards whose source is not identified will be counted.

Invention

In small groups, students will discuss the difficulty of identifying the original sources of the cards and determine whether or not methods can be devised to identify these sources in order to obtain fewer points when playing the game.

Application

Identify some nonpoint pollution sources and construct schemes for controlling their effect.

Teacher Notes

For the Teacher

Created By:
Joyce Meyers
Bernard Hermanson

For Your Information

Try to have groups large enough so that the cards in the discard pile get reused in the draw pile many times. With a deck having eleven books of four cards, five players work well. The key is to make sure the cards are shuffled often. Right after the cards are dealt, stop each Rummy game to change the rules slightly. Each player should add a small blank label to the face of each of their cards. Identify one player per group to mark their labels using a marking pen. The Rummy games can then be finished following regular instructions. When it comes time to tally points, only those cards and books for which the original holder is not known need to be tallied (i.e., the ones with blank labels). The object is to obtain the lowest score. The cards marked with marking pen represent point pollution sources which are easy to identify. The other cards represent nonpoint pollution sources which are difficult to identify. Scoring rules should not be discussed until one full game has been completed.

During the discussion in the Invention, correlations can be drawn between identifying point sources of contamination and nonpoint sources of contamination. Points will be tallied only for those cards which are unmarked. Trying to obtain the fewest points possible, the students will discover how hard it can be to find sources of nonpoint pollution. Some concurrent problems with law enforcement may be discussed. Encourage students to include both urban and rural problems when doing the Application.

Follow-up Suggestions

Collect newspaper articles about water contamination and attempt to categorize the articles in terms of point/nonpoint pollution sources.

Resources
newspapers

Cooperative Extension Service, Iowa State University. Iowa Agriculture and Water Quality. No. Pm 901a through Pm 901j. August 1980.

University of Wisconsin Extension. Nonpoint Source Pollution-Land Use and Water Quality. No. G3025

Other extension service bulletins

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Iowa Natural Heritage Foundation
Iowa Department of Education
University of Northern Iowa

SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Project WILD

STATED GOAL:

To assist learners of any age to develop an awareness, knowledge, skills, and commitment to result in informed decisions, responsible behavior, and constructive action concerning wildlife and the environment upon which all life depends.

FORMAT:

Two paperbound books (K-6 and 7-12), each approximately 245 pages in length and containing over 80 individual activities. Individual activities arranged under these headings: Awareness and Appreciation; Diversity of Wildlife Values; Ecological Principles; Management and Conservation; People, Culture, and Wildlife; Trends and Issues; and Responsible Human Actions.

AVAILABILITY:

Guides available only through participation in a workshop. For information and for workshop schedules, contact:
Project Wild Coordinator - Minnesota
Box 5 DNR Building
500 Lafayette Rd.
St. Paul, MN 55155-4005
(612)297-2423

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

Project WILD is an interdisciplinary education conservation program which emphasizes wildlife. It teaches students to develop an awareness and appreciation of the diverse natural world. Project WILD deals with the relationship between people, culture, and wildlife. It looks at the trends, issues, and consequences which exist between the three. As a program it teaches students to understand the importance of knowing their own opinions and values. Project WILD addresses the need for human beings to develop as responsible members of the ecosystem in order to take constructive actions concerning wildlife and the environment. Project WILD encompasses all the requirements of the education rule thoroughly.

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Health, Social Science, Music

DEADLY LINKS

Objectives
Students will be able to: 1) give examples of ways in which pesticides enter food chains; and 2) describe possible consequences of pesticides entering food chains.

Method
Students become "hawks," "shrews," and "grasshoppers" in a highly-involving physical activity.

Background
People have developed pesticides to control organisms. Herbicides are used to control unwanted plants, insecticides to control unwanted insects, etc. When these pesticides involve use of poisons, the poisons frequently end up going where they are not wanted. Many toxic chemicals have a way of persisting in the environment, and often get concentrated in unexpected and undesirable places—from food and water supplies to wildlife and people, too.

For example, a pesticide (a chemical—frequently synthesized from inorganic compounds—used to kill something identified as a "pest" under some conditions) called DDT used to be applied regularly to crops as a means of controlling insects that were damaging the plants or trees. Then

Age: Grades 4–9
Subjects: Social Studies, Science, Physical Education
Skills: analysis, classification, comparing similarities and differences, computation, description, discussion, evaluation, generalization, kinesthetic concept development, synthesis
Duration: one 30–45 minute period
Group Size: minimum of ten students preferred
Setting: large playing area
Curriculum Framework Reference: VI.A., VI.A.2., VI.A.3., VI.B., VI.B.1., VI.B.2., VI.B.3., VI.B.6., VI.C., VI.C.5., VI.C.6., VI.C.9., VI.C.10., VI.C.11., VI.C.12., VI.D., I.C., I.C.3., I.C.4., I.D.
Key Vocabulary: pesticide, insecticide, herbicide, food chain, accumulate, toxic, chemicals, trade-offs, organic, inorganic

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TO ZONE OR NOT TO ZONE

Objectives
Students will be able to: 1) identify social and ecological considerations where human uses of land conflict with each other and with wildlife habitat needs; and 2) describe the importance of land-use planning.

Method
Students role-play a meeting of a county commission pertaining to a land-use issue.

Background
This activity uses a role-play strategy for study of the importance of land-use planning. It emphasizes the complexities of decision-making where people of different points of view are involved.

The major purpose of this activity is for students to understand the importance as well as some of the complexities of land-use planning and decision-making.

Background for Students
Land use decisions affecting wildlife have become a familiar issue where housing developments are concerned. The following is an imaginary conflict that corresponds to some real life dilemmas:

Pleasant Valley is a ranching-logging community on the western slope of the Snow mountains. Silverton—a town of 20,000—is the trade center of the area. Cramer Lumber Company is expanding its operations. This will provide 250 new jobs, but housing is very limited. A 200 home subdivision has been proposed for an 80 acre plot of undeveloped land on the south edge of town. This forested area is bordered by Rattlesnake Creek on the west. Rattlesnake Creek provides excellent fishing for rainbow trout. Fifty-three species of birds have been sighted in this area, including some rare species. In the spring and fall, the area is used by migrating waterfowl and deer feed in the area. Many nongame species such as ground squirrels and pocket gophers inhabit this land. This 80 acre plot is currently zoned for agriculture and forestry and would have to be rezoned as residential by a vote of the county commissioners. The subdivision would be on a central water system, but each home would have its own septic system.

Age: Grades 6-9
Subjects: Social Studies, Science, Environmental Problems, Language Arts, Speech
Skills: analysis, application, comparing similarities and differences, description, discussion, evaluation, generalization, public speaking, reporting, research, synthesis, writing
Duration: three 45-minute periods
Group Size: large group; depends on students assuming roles
Setting: indoors
Curriculum Framework Reference: VI.A., VI.A.1., VI.A.2., VI.A.3., VI.A.4., VI.B., VI.B.1., VI.B.2., VI.B.3., VI.B.4., VI.B.5., VI.B.6., VI.C., VI.C.1., VI.C.5., VI.C.6., VI.C.7., VI.C.9., VI.C.12., VI.D., VI.D.2.
Key Vocabulary: land-use planning

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Protecting Agricultural Land - Minnesota's AgStravaganza

STATED GOAL:

To help students become aware of the need to protect and conserve soil and agricultural land in Minnesota

FORMAT:

A loose-leaf notebook divided into 7 topic areas for K-6 and 5 topic areas for 7-9. This is a hands-on, experiential curriculm with visual aids, maps, and graphs.

AVAILABILITY:

Curriculum available to teachers involved in workshops. For more information contact:

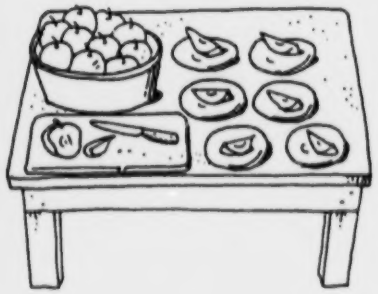
Minnesota's AgStravanza
Box 5 DNR Building
500 Lafayette Rd.
St. Paul, MN 55155-4005
(612)297-2214

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Science, Math, Social Science



- 6 persons (25%) will receive nothing or crumbs
- 6 persons (25%) will receive one slice each
- 6 persons (25%) will receive three slices each
- 5 persons (22%) will receive ten slices each
- 1 person (3%) will receive 25 slices

2. Explain to the group that you are going to serve a simulation snack that reflects how much people around the world get to eat. Ask for discussion on the children's ideas on the distribution of food in the world - how many people go hungry and where they live. Do not let individuals or groups of individuals pretend they represent a particular country. It is important to stress that, while the distribution of the snack represents global food distribution, there are hungry people and well-fed people in virtually every country.

3. Ask the participants not to eat until told to do so. Distribute the snack randomly so that children receiving large portions are close to children receiving small portions and to those receiving nothing.

4. Explain how the distribution corresponds to that in the real world. In some countries, such as the U.S., there are a few very rich persons, many middle-income persons, and a smaller number of poor persons who often go hungry. In some countries, such as Sweden, almost everyone has a middle-income level and no one goes hungry. In some countries, such as India, most of the people are poor and often hungry, but there are a few rich persons and a few middle-income persons. In some countries, such as the People's Republic of China, almost all of the people have low to middle incomes, but no one goes hungry.

Allow the children to react to the situation. Let the group try to work out whether they would like to distribute the food more fairly or to eat it as is. If they choose to change the distribution, let them try to design a fair method in their own way. This should be an extremely difficult task. The purpose of this is to give students a feel for how hard it is for people of the world to negotiate fair solutions to problems.

Note: If your group has had a lot of experience working together and cooperating, you may choose to not allow discussions on redistribution of the snack. If this step is done quickly and easily, it would negate the realism of this simulation of the inequalities in the world.

WHY ARE PEOPLE HUNGRY?

LESSON ONE
AGE: Grade 6
SUBJECT: Social Studies, Geography
SKILLS: Comparison and contrast, discussion, expressive writing
DURATION: 30-40 minutes
GROUP SIZE: Any
SETTING: Indoors
LEARNING PACKET: Activity Sheet A

LESSON TWO
AGE: Grade 6
SUBJECT: Social Studies, Health
SKILLS: Brainstorming, discussion, evaluation, expressive writing
DURATION: 20 minutes
GROUP SIZE: Any
SETTING: Indoors
LEARNING PACKET: Activity Sheet B

LESSON THREE
AGE: Grade 6
SUBJECT: Health, Geography, Mathematics
SKILLS: Analysis, comparison and contrast, evaluation, expressive writing, graphing
DURATION: 40 minutes
GROUP SIZE: Any
KEY VOCABULARY: Infant mortality, population density. See Illustrated Vocabulary.
LEARNING PACKET: Activity Sheets C and D
SOURCE: Food First Curriculum, Institute for Food and Development Policy, 1984

INTRODUCTION

One cause of hunger is that people don't have access to the land they need to grow food. A priviledged minority has economic control over the land, jobs, and other resources that people need to feed themselves.

The extent and importance of this component requires that it be taught in three separate lessons. Each lesson can be taught independently of the others, but for a more complete understanding of the concepts, all lessons should be taught.

Lesson One

Description
The group will be divided up into sections simulating world population divisions and served a snack food divided into portions proportionate to the control of world resources.

Learner Objective
Students will be able to demonstrate that scarcity is not the cause of hunger, but the inequality of the distribution of resources.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Recycle for Reuse - A 4-H Leader, Member, Family Guide

STATED GOAL:

A set of activities designed to make recycling a part of the lives of the participants.

FORMAT:

A 45-page booklet with introductory pages followed by 12 activities for elementary, junior high students. Each activity provides further sources of information.

AVAILABILITY:

Prepared by Cooperative Extension Service, University of Wisconsin - Extension. Available free from:
Waste Education Coalition Clearinghouse
Minnesota Waste Management Board
Sue Thomas, Waste Education Planner
1350 Energy Lane
St. Paul, MN 55108
(612)649-5483

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, contexts)

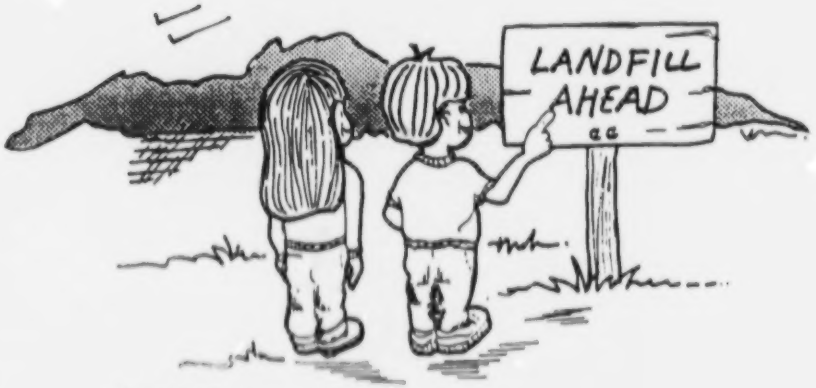
All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Health, Social Science

LANDFILL FIELD DAY

- To see first-hand how landfills are designed and operated.



BIG IDEAS:

LANDFILLS are more than just "holes in the ground" where wastes are dumped.

LOCATING a landfill requires considerable planning and engineering to minimize environmental problems.

LANDFILLS ARE EXPENSIVE and costs are rising.

NEEDED:

- A source of information about landfills (for example: a landfill operator or a city councilman).
- A driver to help transport group to landfill.

LEADERS DO:

1. Arrange a visit to an up-to-date landfill with the operator or owner.
2. If a trip is not possible, have a guest speaker attend a club meeting to be interviewed about today's landfills.
3. Help members prepare to ask questions.

3-D LANDFILL DESIGN

- To better understand elements of landfill design.
- To experience using craft materials to model an environmental project.

BIG IDEAS:

SANITARY landfills are part of the modern landscape.

PROFESSIONAL engineers and landscape architects build similar models when they design a project like a landfill.

NEEDED:

- cardboard boxes
- plywood
- glue or masking tape
- paper mache
- paint
- scissors or knife to cut cardboard

LEADER DOES:

1. Ask each member to bring two cardboard boxes (shoebox size) from home. The boxes should be of approximately equal size.
2. Collect the other materials necessary to build a model landfill.
3. Have the cardboard bases cut before the meeting. You need one base per member.
4. Involve members in discussing what they know about landfills and how landfills look.
5. Have youth leader explain the steps to building the model landfill.

MEMBERS DO:

1. Discuss the elements of a landfill -- how they are built and why.
2. Follow the steps to building a model landfill.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Re: Thinking Recycling - An Oregon Waste Reduction Curriculum

STATED GOAL:

To teach children about the necessity of recycling and waste reduction, as it is practiced in Oregon.

FORMAT:

Divided into 5 levels: K-1, 2-3, 4-5, 6-8, and 9-12. Each level with lessons and extensions. There is also a section of masters for overhead transparencies. Sample lessons include: Costs of Packaging, Plastics, Local Garbage, Economics of Recycling.

AVAILABILITY:

Prepared by Oregon Department of Environmental Quality. Available free from:
Waste Education Coalition Clearinghouse
Minnesota Waste Management Board
Sue Thomas, Waste Education Planner
1350 Energy Lane
St. Paul, MN 55108
(612)649-5483

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Social Science, Language, Math, Music, Science

Overhead 4

Aluminum Can Manufacturing

Bauxite is mined, shipped to the U.S. and transported to factories where electrolysis separates aluminum from bauxite. Aluminum is poured into flat sheets and later shaped into cans.

Tin Can Manufacturing

Iron ore and other minerals are dug from mines and transported to steel mills. The minerals are heated in large vats and poured onto sheets. The steel is coated with tin and shaped into cans.

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Overhead 3

Paper Production

It takes 17 trees to make 1 ton of paper.

Old newsprint is de-inked by washing and rinsing it in large vats of water.

Sometimes newsprint and wood wastes are combined, mixed to a pulp and poured onto large rollers. Other times mostly used paper is processed again.

SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Science-Technology Society: Preparing for Tomorrow's World

STATED GOAL:

A multi-disciplinary approach to problem solving and critical thinking designed to promote decision-making and problem-solving skills needed to deal with issues at the interface of science, technology, and society.

FORMAT:

Twelve independent modules: Energy Use and Conservation; Coastal Issues; Technological Change; Transportation; Communications; Medical Technology; Urban Land Development; Cultural Impact; Space Travel

AVAILABILITY:

Two days training required before ordering materials. Modules vary in price; average $60 per unit. Contact:

Genelle Bentley
N & C MN Reg. State Facilitator
HCR 3, Box 15
Staples, MN 56479
(218)894-1930

-or-

Gail Goltz
SW & WC ECSU
SW State University
Marshall, MN 56258
(507)537-1481

-or-

Diane Lassman
116 University Press Building
2037 University Ave. SE
Minneapolis, MN 55414-3092
(612)624-0584

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH AREAS CAN IT BE INTEGRATED?

Science, Math, Social Science

Reading 10

Pollution Parley

By Gail Robinson

Water Unfit For Fish

We are, of course, at peace. Yet within 20 years the United States may help destroy almost 50,000 Canadian lakes. And a planned Canadian project will pose a very real threat to one of the United States' most cherished wilderness areas.

The war is not intentional, nor are its weapons bullets or bombs. The U.S. and Canada are lobbing sulfur and nitrogen oxides across the border and these gases eventually return to the earth as acid rain. Now the two nations are trying to declare a truce, but, as in any treaty talks, the negotiations promise to be long and complicated.

The acid rain discussions between the U.S. and Canada began in 1978, and last July the countries issued a joint statement announcing that they agreed on such things as the exchange of scientific information on air quality and the reduction of "transboundary" pollution.

In the case of acid rain, most of the "transboundary" pollutants come from coal fired plants, although other fossil fuel plants, automobiles and nitrogenous fertilizers, as well as volcanoes, are also sources. In the atmosphere a chemical reaction converts the sulfur dioxide and the nitrogen oxide into sulfuric acid and nitric acid and then finally, as water droplets fall from the atmosphere, into acid rain.

Before the industrial revolution, rain was virtually neutral — neither acid nor alkaline. Today, according to a recent study published in *Scientific American*, rain and snow in much of the world is five to 30 times more acidic than it would be in an unpolluted atmosphere, and individual storms can be thousands of times more acidic than they should be. A 1974 storm in Scotland was so acidic it was literally as though vinegar were falling from the sky.

Acid rain was observed in England in the 1880s. As early as the 1940s it was killing fish in Scandinavia, and it has now spread to much of northern and central Europe.

[illegible] 1979 © 1979 Environmental Action, 1346 Connecti-

"The Canadian objective," he noted, "is to cut down on pollution coming from the U.S. They don't believe the new source performance standards will solve the problem."

While there are obvious difficulties, they may not be insurmountable. Early in the century, the two governments agreed to keep the boundary waters clean and in 1978 they signed an agreement on water quality in the Great Lakes. There are also international water quality agreements in Europe, and while air is more ticklish to deal with — the U.S. and Canada have never negotiated an air treaty before — European nations are also working to hammer out an accord on acid rain and have already agreed to monitor air.

Throughout the process, the government will be watched by environmentalists. Twenty-five environmental groups will meet at a conference organized by Agle in Toronto on Nov. 1, 2 and 3 to draw up a plan of action. The groups hope their meeting will lead to greater awareness of the acid rain problem, to a discussion of possible political and legal solutions and to the formation of an international citizens network.

It's easy, of course, to be cynical about the treaty talks. How can the Carter administration expect anything from Canada when the U.S. is gutting its own environmental regulations? What right has Canada to get uppity when it still builds coal fired plants without scrubbers? But something clearly has to be done to clean up our air and our lakes. And the U.S.-Canada talks are at least an acknowledgement of the fact that the poisons in our atmosphere know no national boundaries.

Dilemma 4 — THE ACID LAKE AND JOBS

The trout in Lake Lawson, the state's prime fishing area, were diminishing at an alarming rate, according to the latest park survey. The decline in the fish population was traced to the increased acid content of the water, which affects the fish's ability to reproduce. This report gave Governor Jones great cause for alarm, because it meant that an important and scenic area was threatened! The culprits, he knew, were the glass making companies and electricity generating plant located 50 miles west of the park. The plants burn the less expensive high sulfur content coal which emit large quantities of sulfur dioxide. Winds carry the particles eastward which in turn mixes with rain water and forms sulfuric acid. This "acid" rain then falls over the park forest and empties into the lake.

However, the companies had been issued special permits allowing them to burn the high sulfur coal. Despite their use of this type of coal, the state's air quality met the rigorous standards set up by the federal government. If the glass companies were not permitted to use the less expensive coal, they would be forced to close down. Over 20,000 workers would lose their jobs. Since glass making happens to be an important industry to the state, shutting operations would be a severe blow to the state's economy. Without the glass companies, the entire western section of the state might suddenly become a depressed area. If the electric power plant had to switch to the higher priced coal, it would have to charge its customers more for electricity. With the cost of everything being so high already, the residents of that area would have a hard time making ends meet.

Should Governor Jones order the companies to burn low sulfur coal? Or should he allow them to continue to burn high sulfur coal?

DISCUSSION QUESTIONS

- What responsibilities does the governor have to the people of his state? Why? To the parklands and wildlife? Why?
- What should be the governor's main concern? Why?
- Should the protection of natural areas and recreational activities be an important consideration? Why or why not?
- From the perspective of the glass workers what action should the governor take, if any? Why?
- Should people have the right to expect good recreational areas? Why or why not?
- In addition to recreation how might the increase of acid rain be detrimental to the wilderness park area? To the state and its people as a whole?
- Would the governor be treating the glass companies and its workers unfairly if the special permits are withdrawn? Why or why not?
- Is there any way that the glass workers' jobs can be protected?

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

The Source Book 2

STATED GOAL:

To provide information, ideas, inspiration, sample activities, and models in environmental education.

FORMAT:

A compendium of reference of quality environmental education references linking the natural and built environments together; 4 sections - Models; Resources; Readings; and Networking. 160+ pages.

AVAILABILITY:

Cost: $19.95. Available from:
The American Institute of Architects
Publicans Marketing/Sales
1735 New York Avenue Northwest
Washington, D.C. 20006

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

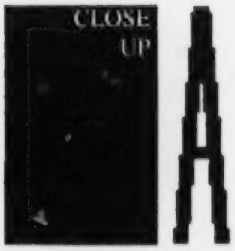
All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Health, Social Science, Music

PROGRAM DESCRIPTION

City Building Education is an interdisciplinary educational program whose centerpiece is the process of designing and constructing a model city in the classroom. This process engages students, teachers, and classroom consultants in a series of explorations into the dimensions of their environment and the dynamics of change. *City Building Education* is Doreen Nelson's innovative yet practical extension of the educational premise that creative and original thinking can be taught.



This goal is accomplished through concrete experiences in transforming familiar objects, ideas, organizations, and environments into something new by altering their form or function, size, shape or scale, direction, movement, or location in space or time. "Developing individual creativity and encouraging students to use this skill in shaping their lives and world," notes Nelson, "are the underlying aims of the *City Building Education* process."

City Building Education has been fully developed and documented for an intensive, one-year, daily classroom endeavor. However, the formal structure of learning sequences has been adapted to a variety of educational settings and populations, including graduate school.

A 6th grader:

"I really got to see what a city means, and I suddenly found out that kids have rights too.

...when you build a city, you see how important your job is and everyone contributes.

I guess I realized I'm not just a nothing person."

The teacher training which accompanies most *City Building Education* programs enables teachers to design their own curriculum. The training introduces the teacher to many of the graphic techniques central to the architectural profession---flow charts, plans, models---as tools to explain concepts visually. Teachers truly become the architects of the classroom, designers of the learning experience. This training is continued through weekly meetings and classroom assistance from *City Building Education* consultants---practitioners and students from the design, science, engineering, and legal professions.

Four pivotal sequences frame the basic *City Building Education* process: selecting the site and building the base model, dividing and distributing parcels of land, developing individual property plans, and, most important, integrating all the elements into the finished classroom model. A History Wall documents this progression through charts, written reports, and pictures.

Elaborating on these core sequences, several activities can be added. The recommended introductory activity has students designing an instant city in a matter of hours, quickly discovering how much more they need to know, what skills they have to develop, and what problems will have to be resolved.

Additional activities strengthen students' understanding of organizations. Students take on the roles of City Hall, the postal system, zoning offices, the stock exchange, and the banking system. Exercises in designing structures, classroom layouts, and public policy all expand

SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Think Twice Before You Toss

STATED GOAL:

To make students aware of household hazardous chemicals and how to handle and dispose of them

FORMAT:

There are 2 sections of mimeographed material - elementary and secondary (7-9). Each section has curriculum materials and teacher background material. Approximately 150 pages.

AVAILABILITY:

Prepared by the Kandiyohi County (MN) Household Hazardous Waste Program. Available free from:
Waste Education Coalition Clearinghouse
Minnesota Waste Management Board
Sue Thomas, Waste Education Planner
1350 Energy Lane
St. Paul, MN 55108
(612)649-5483

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Health, Social Science

HAZARDOUS WASTE IN HOMES

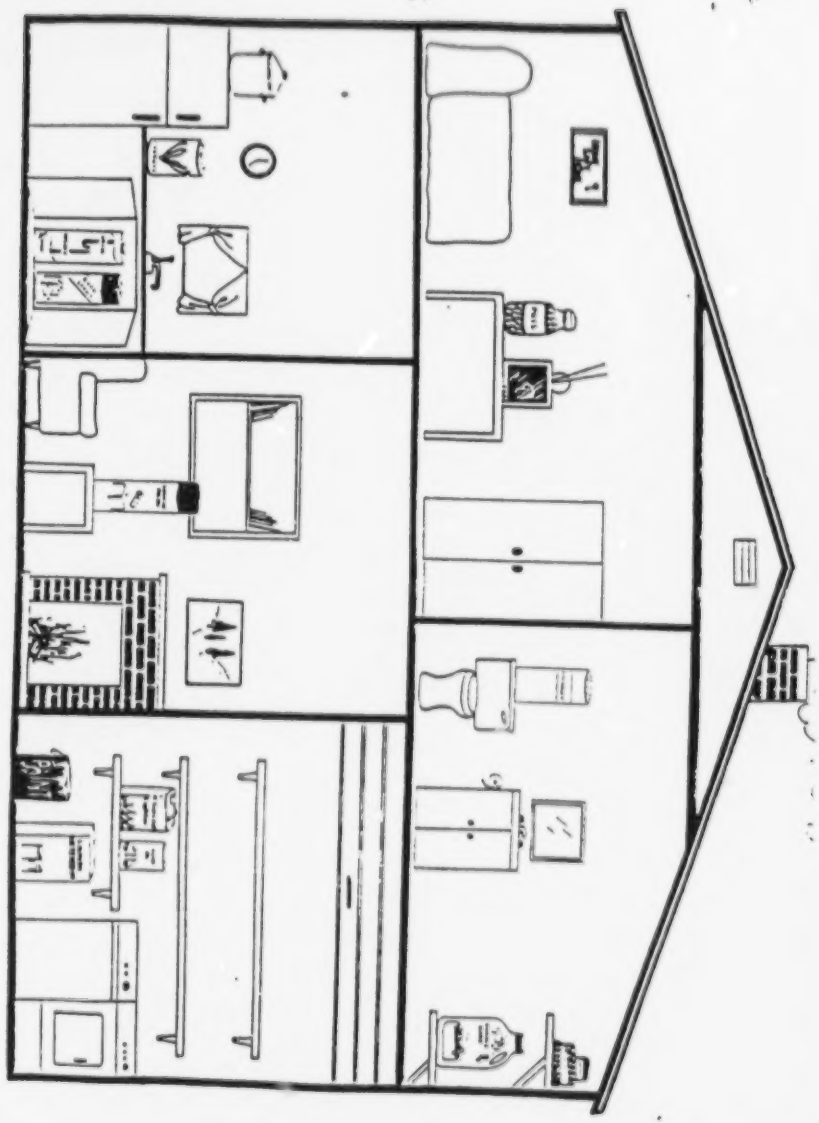
HOUSEHOLD HAZARDOUS WASTE INLCUDES:

Bleach	Pesticides
Disinfectant	Herbicides
Drain Cleaner	Paint
Ammonia	Shellac & Varnish
Oven Cleaner	Paint Thinner
Spot Remover	Roofing Tar
Wood Preservatives	Car Batteries
Old Medicine	Antifreeze
Photography Chemicals	Used Motor Oil
Hobby Supplies	

What We Can Do:

- Be a careful consumer. Buy only the amount you need.
- Read labels. Buy the least toxic products available.
- Avoid aerosols. Many products now come in non-aerosol containers.
- Reuse and recycle. Motor oil, batteries, aluminum and newsprint can be easily recycled.
- Offer leftover, usable products to neighbors, churches, civic groups to use up.
- Never throw away leftover paint. If it's usable, give it away. If not usable, dry it out before landfilling.

For information on proper disposal of household chemicals, call the HHW INFO-LINE: 231-6279 (Kandiyohi County) or 1-800-652-9747.



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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Toxics In My Home? You Bet!

STATED GOAL:

To introduce students to (or increase their awareness of) the potential hazards of common products used in the home -- products such as pesticides, motor oil, pool acids, oven cleaners, solvents, etc.

FORMAT:

Three separate booklets with curriculum for grades 4-6, 7-8, and 9-12. Each booklet has an introduction/conceptual framework; learning activities; and a unit evaluation. This is followed in each volume by appendices.

AVAILABILITY:

Prepared by the Golden Empire Health Planning Center, Sacramento, CA. Available free from:

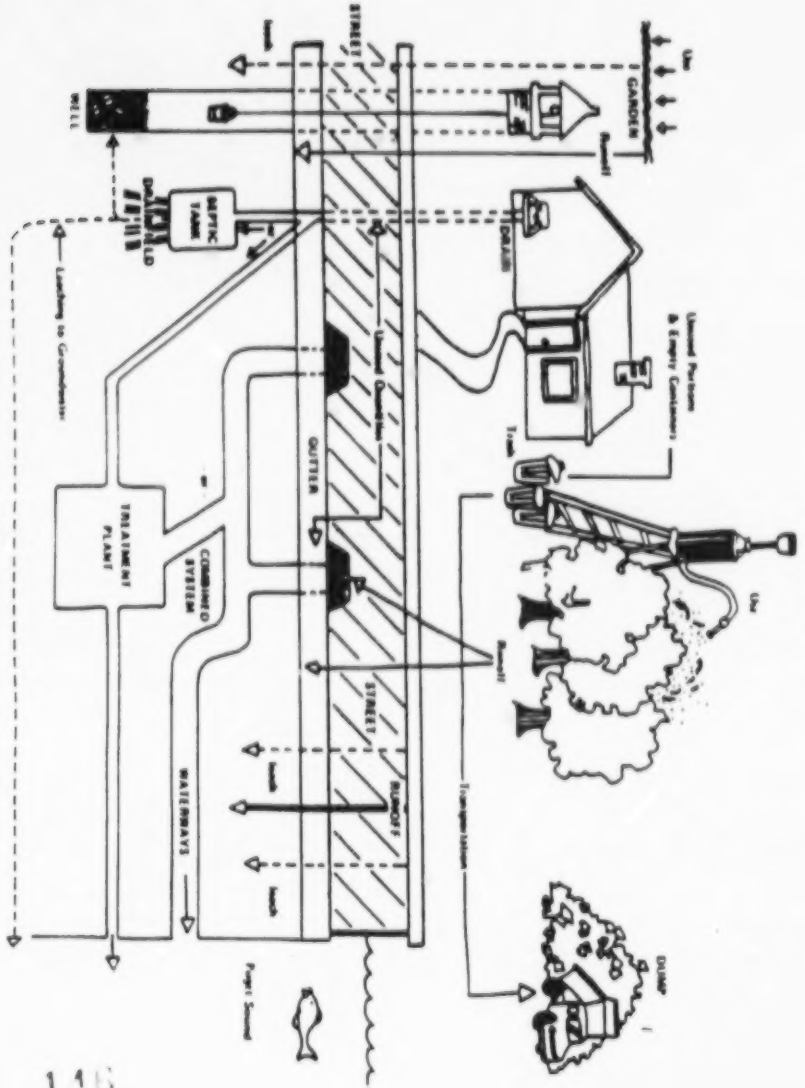
Waste Education Coalition Clearinghouse
Minnesota Waste Management Board
Sue Thomas, Waste Education Planner
1350 Energy Lane
St. Paul, MN 55108
(612)649-5483

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All Contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Science, Health, Social Science



WHAT'S WRONG WITH THIS PICTURE?

On the lines below, write what is unsafe about the situation(s) pictured above and describe how the situation could be made safer.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

*K-12 Wildlife Education Service Curriculum

STATED GOAL:

To develop in children an awareness and appreciation of wildlife

FORMAT:

Material for grades 7-12 is a large, 3-ring notebook with activities, reference materials, posters, etc.

AVAILABILITY:

K-12 $15.00 for "Nature's Notebook" binder (reprints of all "Nature's Notebooks)
7-12 $25.00 for the binder described above
Available from:
Kansas Department of Wildlife and Parks
Wildlife Education Service
Rt. 2, Box 54A
Pratt, KS 67124
(316)672-5911 (Ext. 168)

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Math, Health, Social Science, Music, Physical Education, Handwriting
*These materials are most appropriate for Kansas teachers.

Nature's Notebook
by Joyce Harmon

Wildlife Education Coordinator
Kansas Fish and Game Commission

It might seem unusual to credit wild animals with helping to settle America, but that's just what furbearers did. Native Americans had made use of furbearers as a source of food and clothing for thousands of years. When Europeans began to explore North America, they found the fur from these animals to be of great value for warm clothing, and they used the furs as a unit of currency in the unsettled land. Wealthy Europeans paid high prices for fashionable clothing made of mink, beaver, and other furs. The popularity of felt hats made from beaver fur caused a deeper search into the territory for those animals.

The French, English and Dutch established forts, trading posts, and villages further inland than had been settled prior to this time. The voyageurs, tough wilderness fur traders, traveling by huge birch bark canoes, discovered major waterways, and mountain men pioneered the high passes. Wilderness trails were established by such famous pioneers as Daniel Boone and Kit Carson. These trails became the roads of the future.

Wars were eventually fought over the control of the valuable fur trade. Early settlements established by fur traders grew into towns and cities such as St. Louis, Missouri. The impact of furbearers on America will always be present.

Fashions changed in the 1830's, and agriculture took over areas that had once been wilderness. These changes caused people to view many furbearers differently. They were now labeled as predators of domestic stock, and much of their habitat was converted to crop fields.

Laws and regulations, along with proper management, keep furbearer populations healthy in Kansas. Furdealing remains a major business in the state. There is much yet to be discovered about these history makers. Here's a closer look at some of the furbearing species in Kansas.

coyote

Nocturnal scavengers and predators, coyotes are respected for their craftiness and cunning. Their adaptability has enabled them to expand their range despite large-scale attempts to reduce coyote numbers. They prefer semi-open country and establish dens in unused fields and pastures. They also may establish residence under hollow trees, in rock cavities, and under deserted buildings. Although they do occasionally kill young livestock and poultry, they have often been blamed unjustly for damage done by free-running dogs. They rely on rabbits, mice, and other small rodents for the bulk of their diet, as well as carrion and some plant foods.

raccoon

Expert climbers and swimmers, raccoons usually live in hollow trees near streams, lakes and marshes. They are nocturnal, foraging from dusk to dawn on a diet more varied than that of any other furbearer. Crayfish, clams, fish, insects, frogs, snakes, turtles, wild fruits, grasses, and nuts make up a large part of their diet. They use the tactile senses in their front feet to locate food by groping in shallow pools, under rocks, or in rotting logs. On rare occasions, they can cause problems for rural residents by feeding on corn, eggs, or poultry. They also can be a suburban nuisance by taking up residence in and around buildings inhabited by humans.

beaver

The beaver, largest of North American rodents, is famous for its dam-building capabilities. Beavers customarily confine their activities to a small home range, subsisting largely on the cambium of tender twigs, young trees, and woody plants. They are especially fond of cottonwood and willow bark. Beavers are nocturnal but may be seen during the day, especially in the fall when they are busiest with dam construction. Their dams can stabilize stream flows and control runoff, but sometimes cause problems by backing up water and flooding roads, meadows, and crop fields. Their tree-gnawing tendencies also can cause damage in orchards located near beaver habitat.

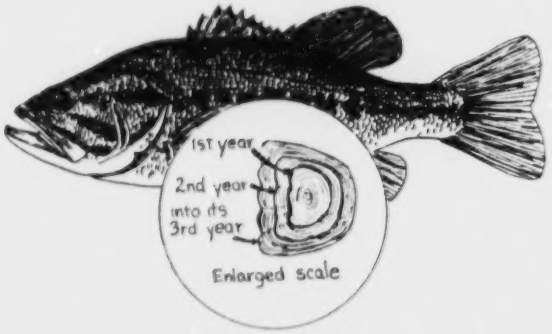
NATURE'S NOTEBOOK

by Joyce Harmon Depenbusch
Wildlife Education Coordinator
Kansas Fish and Game Commission

AS OLD AS THE HILLS

The old saying, "Don't look a gift horse in the mouth," hints at one way the age of an animal can be determined. Techniques used to age wildlife are more complicated than checking a horse's worn teeth, because wild animals won't stand still to be examined. Let's take a closer look at a few of the ways biologists discover how old wild animals are.

Aging certain wildlife and plant species is made easier by **growth rings.** The rings are formed when the tissue of the animal or plant grows rapidly for one part of the year and then very slowly, or not at all, during another part of the year. This change in tissue growth forms bands or rings that can be counted, with each one representing one year. The bands are also called **annual lines** or **annuli.** You may have counted the rings of a tree stump to age it. The growth rings of animals are similar.



The **scales** of many fish have growth ridges, which are formed when the fish grows rapidly in warm weather and slowly in cold weather. Fisheries biologists count these ridges under a microscope. The ridges grow in the spring and summer. When the weather turns cooler, growth is slowed, causing the ridges to form close together. In winter, growth stops, leaving incomplete ridges. Fish can be aged by counting the dark bands left by the winter ridges.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

WIZE: Wildlife Inquiry through Zoo Education
Bronx Zoo, NY

STATED GOAL:

A life science program which improves understanding of concepts related to population, ecology, wildlife conservation, and species.

FORMAT:

Teacher's manual; Student's book; Discovery cards; Photo cards; Student worksheets; Cassette; Filmstrip; Games (Can be used without access to a zoo.)

AVAILABILITY:

One to two days training required before ordering material.
One set of materials for 30 students, $325.00. Contact:

Genelle Bentley
N & C MN Reg. State Facilitator
HCR 3, Box 15
Staples, MN 56479
(218)894-1930

-or-

Gail Goltz
SW & WC ECSU
SW State University
Marshall, MN 56258
(507)537-1481

-or-

Diane Lassman
116 University Press Building
2037 University Ave. SE
Minneapolis, MN 55414-3092
(612)624-0584

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH AREAS CAN IT BE INTEGRATED?

Science, Social Science

Sorting It Out

North American whooping cranes: The males and females have calls of different frequency, duration and volume.

98

Copyright © 1984 New York Zoological Society

Sexually dimorphic animals can identify one another by visual clues. But, in many animal species, the sexes look identical or nearly so. How can these animals tell one another apart?

Species which are not sexually dimorphic, may use ***behavioral signals*** to identify the sexes. Sometimes the signals are very subtle, and difficult for human observers to perceive. One partner advertises and the other identifies the signs and responds.

What are these subtle signals that help animals find suitable members of the opposite sex? They may include behavior, sound, scent, or a combination of these.

(1) Can you name some domestic animals which are *not* sexually dimorphic? How do you think they identify each other?

Behavior

Displays can help distinguish between sexes in non-dimorphic species if each sex performs a distinct set of behaviors during an interaction.

During the breeding season, male frogs seize moving objects in a firm grip. At this point, there are several species-specific clues males use to confirm that the grasped object is indeed a female of the same species.

The sexes of the wood frog do not differ greatly in size, so the object grasped by the male must have certain qualities which he can feel. Females who are ready to breed have a wide girth and their bodies resist compression because they contain eggs. If a female has already laid her eggs, her body will not feel as firm, and the male will release her.

Vocalization: Songs and Calls

Vocalizations are an important part of displays and sex recognition in many non-dimorphic species. Male song sparrows use song for advertisement and pair formation. Males that possess territories advertise to females and other males by singing for nine hours a day. The song serves as an invitation to females to come, breed, and nest. It also warns other males to stay away.

The male may give a different call as he swoops over a potential mate. Females entering a male's territory crouch to show that they are not challenging the male's ownership. This behavior assures the male that the intruder is a female, not a competitor.

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SECONDARY ENVIRONMENTAL EDUCATION CURRICULUM MATERIALS

TITLE:

Wolves and Humans

STATED GOAL:

A study designed to show the relationship between wolves and humans to be integrated into art, literature, history, behavior, and the sciences.

FORMAT:

A 130-page packet containing background readings, classroom activities, vocabulary, map work, drawings, and bibliography.

AVAILABILITY:

Order from:
The Science Museum of Minnesota
Education Department
30 E. 10th St.
St. Paul, MN 55101
1-800-221-9444
Cost: $12.98. 10% discount for teachers.

TO WHICH ENVIRONMENTAL EDUCATION RULE CONTEXTS DOES IT APPLY?
(Contexts: natural, social, valuing, action)

All contexts

INTO WHICH SUBJECT AREAS CAN IT BE INTEGRATED?

Language, Arts, Science, Social Science, Music, History, Psychology

MAPPING AND TERRITORY ACTIVITIES

The following maps are worksheets to be duplicated and given to students. To get the maximum out of these exercises, the sections on Olfaction, Vocalization and Territory should be finished first.

**Map number one depicts a wolf pack's territory. The map symbols are furnished and students can draw them in according to what they have learned about wolves movements and scentmarking.

Discuss the map and work on it together using probable landmarks that would be within wolf territories and invent hypothetical situations relevant to wolves and wolf activities.

Students must first locate the den and rendezvous site. In doing this, they must consider that there are adjacent wolf packs. Dens would therefore not be located near edges. They must also consider that females and pups need water. The female should not have to travel far to get water while she is caring for pups in a den. Students can choose different sites for their den and rendezvous site, but the choices should show understanding about how wolves use their territory and what environmental needs they have.

Tracks: A trail made by the resident pack may be mapped out with white tracks. Where they pass or encounter black tracks of the non-resident "intruders" depicting a "trespassing pack" an arrow in black can be shown indicating a negative scent. Tracks can depict what action the resident pack may choose after such an encounter.

Arrows: Black arrows are used to depict negative scents or encounters, such as human tracks, dwellings or encounters, those things to avoid. White arrows will indicate sites and odors that have a positive implication such as deer, deer trails, familiar trails, rendezvous sites, kills, caches.

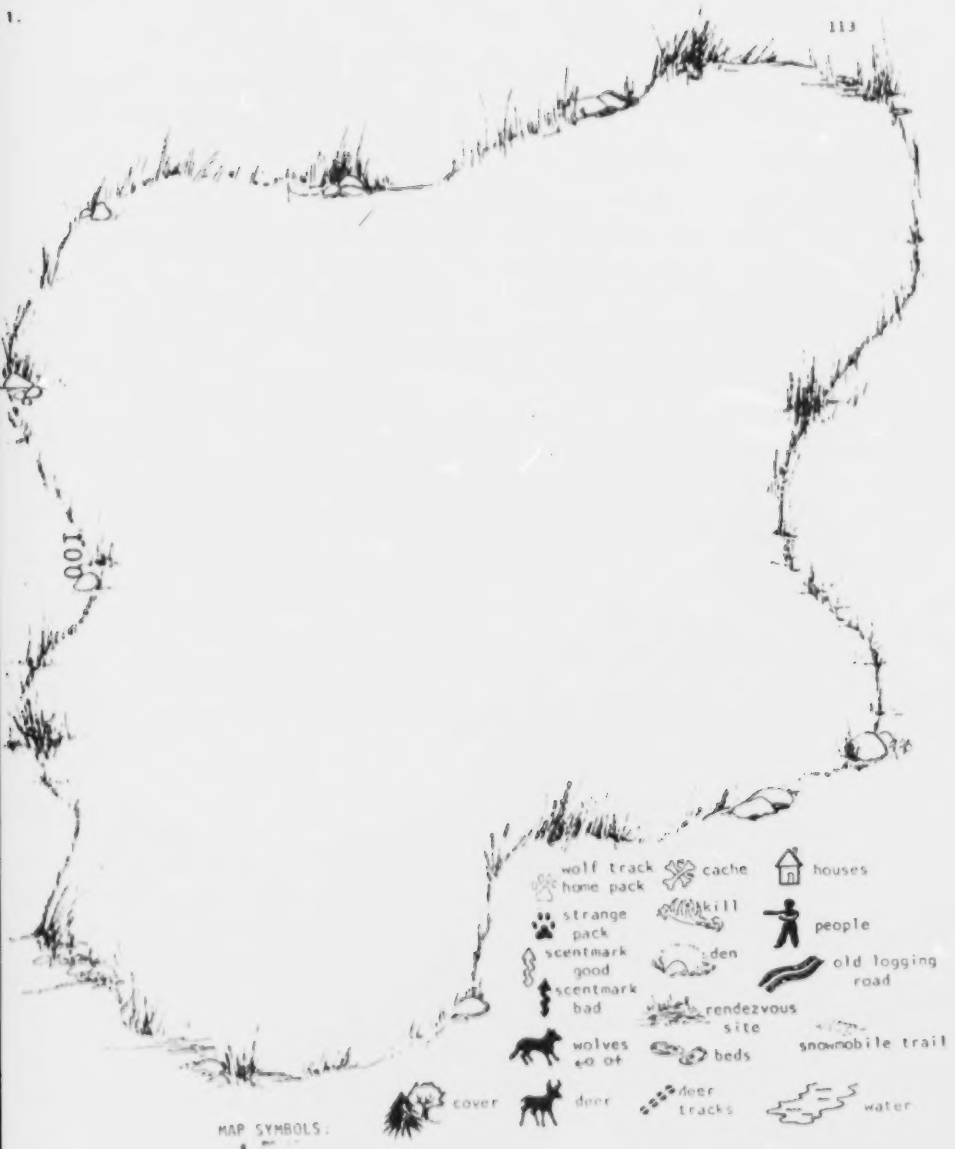
Junctions can be shown to have significant landmarks such as a boulder, and a black or white arrow to indicate if it was marked by the resident pack or intruders, and/or male or female symbols.

Familiar trails or trails leading to and from kills or caches can show many tracks indicating extensive use.

Wolves do use snowmobile trails and logging roads for travel.

Teachers can set up situations or variations to help students try to move through their territory as a wolf might (e.g., a logging road with a fresh scent of man or a kill site that a man discovered and was near).

Breeding season might be depicted with double scent marks made by the breeding pair as they travel within the territory. Use male and female symbols.



MAP SYMBOLS:

BEST COPY AVAILABLE

OTHER RESOURCES

NONCURRICULAR ENVIRONMENTAL EDUCATION RESOURCES

AUDIO/VISUAL MATERIALS
(Listed Alphabetically by Supplier)

Karlyn Atkinson-Berg
Wildlife Education Program for a Living Future
Rt. #2 Box 225 A
Bovey, MN 55709
(218)245-3049

Wildlife, Wolves, and Wilderness - a variety of slide programs with full display on the ecology, behavior, and history of the wolf. For all ages.

Bullfrog Films, Inc.
Oley, PA 19547
(215)779-8226 or 1-800-543-FROG

Films on Energy - a catalog of excellent films on energy. Includes titles on Conservation, Solar, Wood, Geothermal, Wind, Hydro, Biogas, Energy Policy, and Heat Pumps. Available as video tapes and some titles in 16 mm format. May be purchased or rented.

Crystal Productions
Box 2159
Glenview, IL 60025
1-800-255-8629

Energy related filmstrips including:

Sunshine Kids-Constructing A Solar Greenhouse	(7-adult)	$35.95
Solar Energy At Work	(7-Adult)	$34.95
Solar Power	(7-Adult)	$34.95
Sun Up	(7-Adult)	$34.95
Wind Energy	(7-Adult)	$34.95

Edison Electric Institute
1111 19th St. NW
Washington, D.C. 20036-3691
(202)778-6590

Edison Electric Institute Publications Catalog (1989) - has several films/video tapes available for purchase. Sample titles include: Sam's Most Electrifying Account; To Catch A Cloud - A Thoughtful Look at Acid Rain; It's an Electric Life. Check with your electric utility company about availability or contact the above address for catalog.

Minnesota Agriculture in the Classroom
Al Withers, Program Director
90 W. Plato Blvd.
St. Paul, MN 55107
(612)296-6688

The Minnesota Guide to Educational Resources About Agriculture - contains several films and filmstrips relating to agriculture. Also included in the 97-page publication are dozens of other resources on agriculture.

Minnesota Department of Natural Resources
500 Lafayette Rd.
St. Paul, MN 55155-4046

Bureau of Information and Education, Box 46, 16mm films, videotapes (VHS ½" only), slides and cassettes on various subjects. A partial list given because of large inventory; write to address above giving catalog number and film name.

Frogs & Toads (cat.#507), MN Family of Snakes (cat. #518), Let's Talk Turtles (cat. #518), Hello, I'm a Loon (cat. #520), Bluebirds (cat. #510), Saving America's Bats (cat. #511), Bats: Myth and Reality (cat. #524). All are slides and cassettes.

Bluebirds, Bring Them Back (cat. #087) 16mm, Two Little Owls (cat. #068) 16mm, The Greater Sandhill Crane Story (cat. #144) 16mm, Peregrine (cat. #158) 16mm.

Minnesota Environmental Education Board
500 Lafayette Rd. Box 5
St. Paul, MN 55155

Crises In The Rain - 16mm film (28 minutes). Upper elementary and up. Introduction to the origins and significance of the problem.

Minnesota Environmental Education Board
1202 E. Highway 2
Grand Rapids, MN 55744
(218)327-4445

Wolf Learning Box - a foot locker with materials for 12 learning stations and written materials. Also 4 group stations with videos and tapes. Teachers instructions included.

Minnesota Geological Society
2642 University Avenue
St. Paul, MN 55114-1057

Dunes of the Anoka Sand Plain - this set of 48 slides in a carousel/script describes the geology of the Anoka Sand Plain. $5.00 rental fee.

Land That Glaciers Built - is a set of 48 slides in a carousel with a 19-minute taped narration. The program illustrates the glacial history of Minnesota. $5.00 rental fee.

Minnesota Pollution Control Agency
520 Lafayette Rd.
St. Paul, MN 55101

Contact the film library for titles.

National Geographic Society
Educational Services
Dept. 89
Washington, D.C. 20036

The 1989 Film and Video Catalog contains many titles on environmental and energy-oriented topics. Films and videos may be purchased from the above address or by calling 1-800-368-2728. Rentals and preview requests should be addressed to:

Karol Media
22 Riverview Drive
Wayne, NJ 07470-3191
(201)628-9111

A catalog of titles is available.

Solar Electric Engineering, Inc.
175 Cascade Ct.
Rohnert Park, CA 94928
Att: Gary Starr
(707)586-1987

Has available solar slide shows:

Passive Solar
Hot Water
Photo Voltaics
Solar Ovens
General Energy

Cost: $25.00

U.S. Fish & Wildlife Service
Federal Building
Fort Snelling
Twin Cities, MN 55111
(612)725-3582

Free catalog of 16mm films and videotapes available.

Wisconsin Division of State Energy and Coastal Management
Dept. of Administration
PO Box 7868
Madison, WI 53707

Energy Audiovisuals on Loan - a brochure listing energy titles of slide/tape programs, 16mm films, and video cassettes. (Out of state requests will be honored after in-state needs are met.)

NONCURRICULAR ENERGY AND ENVIRONMENTAL EDUCATION RESOURCES

BOOKS, BOOKLETS, BROCHURES, AND MAGAZINES
(Listed Alphabetically by Supplier)

(The) Acid Rain Foundation, Inc.
1410 Varsity Drive
Raleigh, NC 27606
(919)828-9443

Acid Rain in Minnesota (New in 1989) - a 20-page booklet prepared by MPCA, MN DNR, Dept. of Health, and MDE; published by The Acid Rain Foundation, Inc. $4.00/copy.
Information Packet on Acid Rain - general information on acid rain. $9.95/packet.
Acid Rain Coloring Book - called "Rain, Rain Go Away" for young children. $3.00/copy.
Tree Cores - borings from a red spruce tree, ready for finishing. $10.00/set.
The Air Around Us (1989) - a booklet of issues of air pollutants and air quality. $9.95 + $2.00 postage/handling.
Acid Rain Reader (1989) - a dictionary of air quality terms, illustrated. For students in grades 4-8, to accompany curriculum materials on acid rain. $6.95.
Acid Rain: Science Projects (1989) - experiments for students in grades 5-12 with information sources and further topics of study. $9.95 + $2.00 postage/handling.

American Coal Foundation
918 Sixteenth St. NW
Suite 204
Washington, DC 20006

Several titles of booklets and reference materials including:

About Coal	4-6	Free
Coal	7-12	Free
Coal: An Introduction	5-8	$4.25
What Everyone Should Know About Land Reclamation	4-12	Free
What Everyone Should Know About Electricity From Coal	4-12	Free
Let's Learn About Coal	4-8	Free
Power From Coal	4-8	Free
Balancing Needs: Coal In The Environment	9-12	Free

American Council for an Energy Efficient Economy (ACEEE)
Suite 535
1001 Connecticut Ave. NW
Washington, DC 20036
(202)429-8873

An organization devoted to energy efficiency. Two publications appropriate for secondary use are:

Saving Energy and Money With With Home Appliances	9-adult	$2.00
The Most Energy-Efficient Appliances	9-adult	$2.00

Free Catalog Available

American Gas Association
Educational Programs
1515 Wilson Blvd.
Arlington, VA 22209

They provide a catalog of natural gas teaching materials developed to supplement classroom textbooks. There is heavy emphasis on conservation. Catalog titles are generally available free to teachers. Films and software are not free but are often provided by the local gas company on a free loan basis. Catalog available from above address. Check with your local gas company for availability of materials. Includes elementary and secondary materials which can be integrated into science, social science, math, and chemistry.

American Petroleum Institute
Educational Liason
Susan Hahn
1220 L St. NW
Washington, DC 20005
(202)682-8118

Several titles available for 7-adult audiences. Single copies are free to teachers. Prices available for multiple copies from above address.

Facts About Oil
Petroleum Exploration
The Language of Energy
Average Annual Yield from a Barrel of Crude Oil

California Energy Extension Service (CEES)
1400 Tenth St.
Sacramento, CA 95814
(916)323-4388

CEES has a number of publications for schools including such titles as: Bright Ideas Notebook (for administrators, faculty, parents, on school-based energy management); Energy Activities For The Elementary Classroom; Energy Patrol Packet; Power Lines; Energy Conservation Game. Write to above address for complete listing and ordering information.

CETA (Connecticut Technology Education Association)
Media Library
PO Box 652
New Milford, CT 06776

Alternative Energy a book from Connecticiut State Department of Education suitable for technology education classes. $5.00 per copy. Check made out to CETA must accompany order.

Channing L. Bete Co., Inc.
200 State Road
South Deerfield, MA 01373
1-800-628-7733

More than 60 informative 16-page booklets and coloring books covering many different energy topics. Some sample titles are:

My Book About Electricity	K-1
Electrical Safety	K-4
About Hydro-Power	4-adult
Water: Our Most Valuable Resource	4-adult
Let's Save Energy	5-6

Free catalog and sample review copies are available. Minimum order: 25 booklets. Bulk price example: from 25-49 booklets - $.79 each.

Charles Edison Fund
101 S. Harrison St.
East Orange, NJ 07018
(201)675-9000

Provides the Edison Teaching Kit consisting of 7 booklets:

- Energy Conservation
- Useful Science Projects
- Simple Experiments on Magnetism and Electricity
- Nuclear Experiments You Can Do
- Energy For The Future
- Selected Experiments and Projects
- Environmental Experiments

These are prepared for use in grades 5-9. Kit: $1.00 from above address.

Conservation and Renewable Energy Inquiry and Referral Service
(CAREIRS)
PO Box 8900-ED
Silver Spring, MD 20907
1-800-523-2929

Several free items available from this address:

Solar Energy and You	FS118	1-6	Free
Learning About Energy Conservation	FS218	1-6	Free
Wind Energy Systems	FS135	6-adult	Free
Biofuels as a Source of Energy	FS214	6-adult	Free

Please include FS numbers when ordering.

Edison Electric Institute
1111 19th St. NW
Washington, DC 20036-3691
(202)778-6590

Edison Electric Institute Publications Catalog 1989 - has an education section which has numerous titles including:

Alternative Energy Sources:	
Experiments You Can Do	5-10
The Electric Timeline	10-adult
Electricity Serves Our Community	K-6
A Basic Guide to Nuclear Power	6-12

This catalog also has a section on environmental issues with several titles on Acid Rain; Electricity and the Environment; Electric and Magnetic Fields; and Answers to Your Questions. Contact your electric utility company or the above address for more information.

Environmental Learning Center
Friedrich City Center
Red Wing, MN 55066
(612)388-7339

I Do And I Understand - a book containing numerous color photographs and descriptions of various environmental education activities ranging from maple syrup production to building log cabins. $14.85/copy.

Geological Survey Bureau, Iowa DNR
123 N. Capitol St.
Iowa City, IA 52242
(319)335-1575

Iowa Geology - an annual publication for the purpose of communicating important and interesting aspects of the state's geology to the public. 32-pp, color-illustrated, with 8 or 9 articles on various topics concerning the state's geology. No charge for publication - just request name be added to mailing list.

Harcourt Brace Jovanovick
1250 6th Ave.
San Diego, CA 92101

Oceans of Energy:		
Reservoir of Power for the Future	7-adult	$9.95
Small Energy Sources:		
Choices That Work	7-adult	$17.95

Two hardcover books by Dr. Augusta Goldin, related to energy.

Innovative Communications, Inc.
207 Coggins Drive
Pleasant Hll, CA 94523
(415)944-0923

Educational Resources Catalog - contains several energy education and water education entries. Sample titles are:

- Aunt Energina's Almanac
- The Professor Wattensockett Safety Book
- Water Fun
- Captain Hydro

All materials are graded and have student workbook and teacher guide. Materials cover K-12 and adult. Catalog available from above address.

Minnesota Department of Natural Resources
Division of Forestry
Forest Information Officer
Box 44
500 Lafayette Rd.
St. Paul, Mn 55155-4044

Publications and Fact Sheets - is a listing of some 70 booklets and sheets on forest and wood topics. Publications range from tree planting, heating with wood, tree diseases, and forest management. Contact above address for list of free publications.

Minnesota Documents Division
117 University Ave.
St. Paul, MN 55155
(612)297-3000 or
1-800-652-9747

Landscaping for Wildlife - how to attract wildlife to the yard, farm or woodlot. Information on planting to attract butterflies, hummingbirds, song birds, pheasants, and deer. Produced by the Minnesota DNR Nongame Section. $6.95 + $1.50 shipping/handling.

Woodworking for Wildlife - a 47-page book on homes for birds; with construction diagrams and information on proper placement of boxes in the habitat. Produced by the Minnesota DNR Nongame Section. $3.95 + $.50 shipping/handling.

Minnesota's Favorite Winter Birds - a full color 22"x17" poster of common winter birds. $4.00 + $1.50 shipping/handling.

Minnesota Environmental Quality Board
300 Centennial Building
658 Cedar St.
St. Paul, MN 55155
(612)296-2603

Minnesota Environmental Directory - is a listing of environmentally-oriented organizations in federal, state, and regional offices in Minnesota. Also included are lists of citizen, professional, and industry environmental organizations. Directory is revised every other year (will be done in 1990) and is available in all public libraries. Copies for individuals may be available from EQB at no cost depending on the supply. The number made available is dependent on legislative funding.

Minnesota Geological Society
2642 University Ave.
St. Paul, MN 55114-1057

The Search for Oil and Gas in Minnesota - by G. B. Morey, is a 30-page booklet outlining the history of oil and gas exploration in Minnesota. Included are illustrations and maps on: Briefing on Petroleum, Geology of Minnesota and the Upper Midwest, Hydrocarbon Occurrences in Minnesota, Wildcat Exploration for Petroleum in Minnesota.

List of Publications in Print - has all books, reports, maps, and miscellaneous publications available from the MGS as well as publications from the U.S. Geological Survey.

Minnesota Pollution Control Agency
Public Information Office
520 Lafayette Rd.
St. Paul, MN 55101
(612)296-6300 or
1-800-652-9747

Breaking the Landfill Habit - six informative sheets on alternatives to landfills.

(The) Minnesota Project
Box 4
Preston, MN 55965

Protecting Groundwater Through Sustainable Agriculture - an introduction to farming practices that can keep groundwater pure. A 41-page booklet in three parts:

I - The problem of ag chemical pollution
II - Specific farm practices that protect groundwater
III - List of information sources for further reading

$2.50 from above address.

Groundwater Action Guide - a 38-page booklet which provides information needed by individuals and groups to take action to protect groundwater. Covers key groundwater issues; local groundwater programs and policy action options; state groundwater programs and policy action options; two appendices with listings of environmental groups and state agencies; and a bibliography. Available from the above address: $2.50.

National Energy Foundation
Resources for Education
5160 Wiley Post Way, Suite 200
Salt Lake City, UT 84116
(801)539-1406

This organization has a catalog of energy education materials. Sections on Posters and Energists (newspaper format with background information); Frameworks; Guides and Glossaries; Lesson Plans; Kits and Water Materials. Description and prices are included.

National Geographic Society
Educational Services
Dept. 89
Washington, DC 20036
1-800-368-2728

The 1989 National Geographic Educational Services Catalog - contains many titles in computer courseware, filmstrips, videodiscs, books, maps, etc. Some of the titles are oriented to energy and environmental education. Items may be ordered on 30-day approval from toll free # above.

Nuclear Information and Resource Service (NIRS)
1424 16th St. NW
Washington, DC 20036
(202)328-0002

Teaching Nuclear Issues - a resource guide for secondary school teachers which includes listings of audio/visual materials; books; pamphlets and periodicals; classroom materials; and other resource organizations.

Groundswell - a newsletter for those concerned about nuclear power issues.

Information and publications list is available from above address.

Ohio Agricultural Education Curriculum Materials Service
Agricultural Adminstration Bldg., Room 254
The Ohio State University
2120 Fyffe Road
Columbus, OH 43210-1099
(614)2924848

The Science Workbook - a handbook for high school and middle school students and teachers. The book was created to promote the fact that food, agricultural, and natural resource sciences are in essence, the practical application of the biological and physical sciences. The book presents student research projects in food, agriculture, and natural resources. $1.75/copy + $.80 postage/handling.

Peoples Natural Gas
(Contact Local Office) or
Eagan, MN
(612)452-0890

A variety of tapes and brochures are available describing natural gas production, transport, use, and safety. (These are generally not available from the local office but will be shipped from the Omaha office.)

Solar Electric Engineering, Inc.
175 Cascade Ct.
Rohnert Park, CA 94928
(707)586-1987
Att. Gary Starr

Has the following materials available:

Solar Electric Inventor Kit	4-12	$6.95
Solar Power Demonstration	K-12	$5.00
The Solar Electric Book	6-12	$7.17
Mini-Solar Electric Kit (Cell and motor)	4-12	$4.50

University of Minnesota Press
2037 University Ave. SE
Minneapolis, MN 55414

Minnesota's Endangered Flora and Fauna, Editors, Coffin and Pfannmuller - is a listing of 300 species ranging from jumping spiders to mosses and lichens and including vascular plants, birds, mammals, reptiles and amphibians, fish, butterflies, molluscs, and tiger beetles -- all of which are in jeopardy. Individual status accounts are provided for all endangered, threatened, or special concern species. Published for the Minnesota DNR Nongame Section. $49.50 Clothbound; $16.95 Paper.

Waste Education Coalition Clearinghouse
Minnesota Waste Management Board
1350 Energy Lane
St. Paul, MN 55108
(612)649-5482

Teachers Resource Guide - this booklet lists curricula, books, audiovisual materials, and Minnesota resources for resource recovery, grades K-12.

Wisconsin Division of State Energy and Coastal Management (DSE)
Dept. of Administration
101 S. Webster St., 6th Floor
PO Box 7868
Madison, WI 53707
(608)266-8234

Wisconsin Energy News - is a bimonthly newsletter designed to inform readers about programs, policies, and research in energy conservation, renewable energy technology, and other energy resources in Wisconsin and the upper midwest. Free upon written request.

Wisconsin Energy Bureau Fact Sheet - these are one-page sheets providing information on the energy efficiency of home appliances.

Popular Energy Publications - a listing and order blank for many titles under the headings of General, Residential, Conservation, Superinsulation, Solar, Wood, and Biomass.

World Watch Institute
1776 Massachusetts Avenue NW
Washington, DC 20036
(202)452-1999

World Watch - a bimonthly magazine with global perspectives on critical issues. Stories on such issues as energy, population, food production, social trends, environment, and sustainable development are featured. One-year subscription $20 can be ordered from:

World Watch
PO Box 6991
Syracuse, NY 13217-6991

DIRECTORIES AND BIBLIOGRAPHIES
(Listed Alphabetically by Supplier)

The Acid Rain Foundation, Inc.
1410 Varsity Drive
Raleigh, NC 27606
(919)828-9443

International Directory - 400 scientists, educators, and policy experts who will speak on acid rain. $8.00

Resource Directory (1985) - listing of public, private, and educational resources available from industry, government, environmentalist, and public interest groups. $10.00

Acid Deposition Bibliography - listing of scientific papers, symposia, books, and pamphlets on acid rain. Useful for student research. $8.00

Energy and Education
%NSTA Special Projects
5112 Berwyn Road, 3rd Floor
College Park, MD 20740
(301)220-0874

Energy and Education - a newsletter published by the National Science Teachers Association speaks directly to teachers. Included are listings of free and inexpensive materials, book and material reviews, current data on the energy situation, and news on the energy education community. Energy and Education is published 5 times per school year, October through June. $9.00 per subscription/per year.

Directory of Energy Education Materials - is included in the subscription to Energy and Education. Single copies of the Directory are $2.50 from the above address.

Minnesota Agriculture in the Classroom
Al Withers, Program Director
90 W. Plato Blvd.
St. Paul, MN 55107
(612)296-6688

Minnesota Guide to Educational Resources About Agriculture - a resource for K-12 educators is a soft-bound 97-page guide. It is cross-referenced by producer, agricultural subject area, and physical components. It includes many Minnesota based resources as well as selected national resources, all for various K-12 audiences. Guide is free from above address.

Minnesota Pollution Control Agency
520 Lafayette Rd.
St. Paul, MN 55155
(612)296-6300 or 1-800-652-9747

Teachers Guide: Educational Materials in Resource Recovery - grades K-12 nationwide listing of curricula, books, and audiovisual materials available on resource recovery.

SMEAC Information Reference Center
1200 Chambers Rd.
Columbus, OH 43212
(614)292-6717

Bibliography - of energy materials dated 1980-1988, produced for teachers. Includes all materials in the ERIC system; available July 1, 1989; price not yet fixed, approximately $6.00.

Energy Activities for the Classroom, Vol. 1 and Vol. 2 - K-12 in scope. Current prices listed, subject to change July 1, 1989. Vol. 1 - $5.69; Vol. 2 - $3.45.

U.S. Department of Agriculture
Office of Governmental and Public Affairs
Special Programs
Room 535A
Washington, D.C. 20250

List of Available Publications of the U.S.D.A. - is a listing of materials on agricultural economics and engineering, conservation, entomology, forestry, etc. Also a section on charts and posters available. Most of the titles can be ordered from:

Superintendent of Documents
Washington, D.C. 20402-9325

ENVIRONMENTAL EDUCATION FACILITIES
(Listed Alphabetically by Name)

Barlage Center for Science
Moorhead State University
Moorhead, MN 56560
(218)236-2904
Description: A facility to provide science/environmental education for all ages. It is available to public and private schools all year. Schools may schedule one day field trips in advance. There is no charge except for special events.

Belwin Outdoor Education Lab
1553 Stagecoach Trail South
Afton, MN 55001
Sharon Eaton, Director
Description: A nature center for St. Paul and Stillwater Public Schools only. A 320-acre site with a nonresidential program.

Blue Mounds State Park Interpretive Services
Rt. #1
Luverne, MN 56156
(507)283-4892 Park Office
(507)283-4548 Interpretive Center
Description: Slide/talks, hikes, and demonstrations given to park visitors, by request, to promote understanding, appreciation, and enjoyment of natural and cultural resources in southwestern Minnesota.

Camp Courage
Rt. #1 Box 258
Maple Lake, MN 55358
(612)963-3122
Kurt D. Marple, Environmental Education Coordinator
Description: Camp Courage offers overnight outdoor and environmental education field trips for elementary schools. Free planning guide available by calling Courage Center at (612)-520-0505. Free planning and program information can be obtained by contacting the Environmental Education Coordinator.

Deep Portage Conservation Reserve
Rt. #1 Box 129
Hackensack, MN 56425
(218)682-2325
Mike J. Naylon, Director
Description: A public demonstration and education site on 6100 acres including 26 miles of trails, 5 lakes, and 2 rivers. Resident programs from 2 to 5 days available.

Lake Carlos Environmental Center
Rt. #5, West Lake Carlos
Alexandria, MN 56308
(612)846-2431
Susan Harris, Environmental Education Director

Lake Carlos Environmental Center, cont'd.

Description: A year-round residential and day camp located 7 miles north of Alexandria, MN. It has winterized facilities for 120 students. Natural setting includes: maple-basswood forest, lake, pond, marsh, and native prairie.

Long Lake Conservation Center
Rt. #2, Box 2550
Palisade, MN 56469
(218)768-4653
Bob Schwaderer, Executive Director

Description: A residential center providing experiential-based conservation/environmental education in a natural setting. Reservations on a first-come-first-served basis. A pre-trip planner, The Long Lake Experience describes programs.

Minnesota Valley Nature Center
6601 Auto Club Road
Bloomington, MN 55438
(612)944-1423
Contact: Arden Aanestad

Description: 50 acres along the Minnesota River in Bloomington, MN, featuring the "Red Barn Learning Center". The property contains natural springs, brooks and ponds, and bottomland timber. A trail covers the property and provides a one hour tour. The learning center has materials and activities planned for children and adults.

Northlands Resource Center (NWRC)
NWRC Director
1761 University Avenue
St. Paul, MN 55104
(612)645-6605

Description: The North Woods Resource Center (NWRC) is a residential environmental education center located 14 miles north of Ely, MN, and ½ mile from BWCAW. NWRC offers programming for students in grades 4-12 in the fall, winter, and spring. The program offers opportunities for learning in natural history, recreational skills, and social development from within small community setting (student to staff ratios average 6 to 1). The broad curriculum offerings at NWRC can address many programming themes.

Red River Valley History Area
Natural Resource Department
University of Minnesota Technical College
Crookston, MN 56716
(218)281-6510, Extension 310 or 312
Dan Svedarsky or Tom Feiro

Description: An 85-acre site offering a variety of habitats representative of the Red River Valley. Wetlands, marsh, cottonwood lowlands, aspen forest, and prairie characterize the area. A portion of the area is accessible to handicapped. A one room nature center is available.

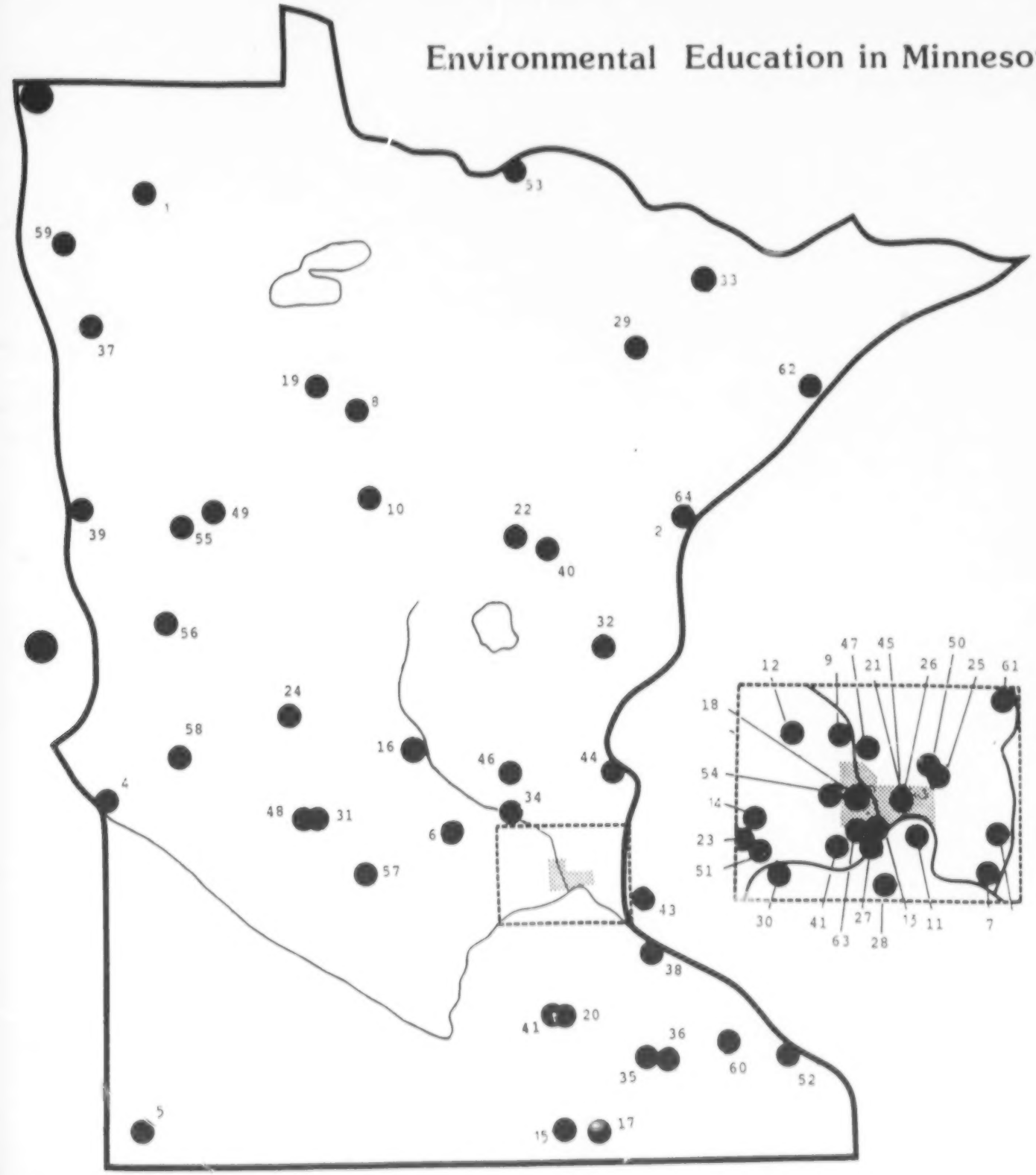
St. Croix Environmental Center
YMCA Camp St. Croix
532 County Road F
Hudson, WI 54016
(612)436-8428
Patty Mueller, Senior Naturalist
Brad Konkler, Program Director

Description: A residential environmental education center on a 400-acre site. Winterized buildings can accommodate up to 150 students for a 2-5 day period. All instruction provided. Located 20 miles east of St. Paul.

Wolf Ridge Environmental Learning Center
230 Cranberry Road
Finland, MN 55603
(218)353-7414
Jack Pichotta, Director

Description: A residential facility along the north shore of Lake Superior. "The primary emphasis of Wolf Ridge is educational programs for youth, typically 10-12 years old, because this is a highly impressionable age when children can learn lifelong lessons from outdoor experiences." Special programs include: Superior Summer Program, a camp for students aged 9-12; Education Vacation; Rock Climbing School; and BWCA Canoe Trips.

Environmental Education in Minnesota



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compiled by Minnesota Naturalists Association
c/o Bell Museum of Natural History 10 Church St. S.E. Minneapolis, MN 55455 1989

FACILITIES

1. Agassiz NWR
Middle River, MN
56737 (218) 449-4115
2. BWCA Superior NF
515 W. 1st St. Bx 338
Duluth, MN 55801
(218) 727-6692
3. Belwin Outdoor Ed. Lab.
1553 S. Stagecoach Tr.
Afton, MN 55001
(612) 436-5243
4. Big Stone NWR
25 NW 2nd St.
Ortonville, MN 56278
(612) 839-3700
5. Blue Mounds St. Pk.
Rt. 1, Luverne, MN
56156 (507) 283-4892
6. Camp Courage, E.E. Overnight Ctr.
Rt. 1, Maple Lake, MN
55358 (612) 963-3121 x20
7. Carpenter Nat. Ctr.
12805 St. Croix Trail
Hastings, MN 55033
(612) 437-4359
8. Chippewa Nat. Forest
Cass Lake, MN 56633
(218) 335-2226
9. Coon Rapids Dam Reg'l Pk.
9750 Egret Blvd.
Coon Rapids, MN 55433
(612) 757-4700
10. Deep-Portage Cons. Reserve
Box 129,RR1, Hackensack, MN
56452 (218) 682-2325
11. Dodge Nat. Ctr.
1795 Charlton St.
W. St. Paul, MN 55118
(612) 455-4531
12. Eastman Nat. Ctr.
13351 Elm Creek Rd.
Osseo, MN 55369
(612) 420-4300
13. Fort Snelling St. Pk.
Hwy. 5 & Post Rd.
St. Paul, MN 55111
(612) 727-1961
14. Gray Freshwater Biol. Inst., 2500 Shadywood Rd.
Navarre, MN 55392
(612) 471-8476
15. Helmer Myre St. Pk.
Rt. 3, Bx 33, Albert Lea,
MN 56007 (507) 373-5084
16. Heritage Park. Nat. Ctr.
225 33rd Ave. S.
St. Cloud, MN 56301
(612) 255-7255
17. Hormel Nat. Ctr.
Bx 673, Austin, MN
55912 (507) 437-7519
18. J.F. Bell Museum of Nat.Hist.
U of M, 10 Church St. S.E.
Mpls., MN 55455
(612) 624-1852
19. Lake Bemidji St. Pk.
Rt. 5, Bx 44, Bemidji, MN
56601 (218) 751-1472
20. Faribault State Hospital & Sch.
Outdoor Ed. Dept, Rogers Bldg
Faribault, MN 55021
(507) 332-3492
21. Lee & Rose Warner Nat. Ctr.
30 E. 10th St., St. Paul, MN
55101 (612) 221-9444
22. Long Lake Conservation Ctr., Palisade, MN
56469 (218) 768-4653
23. Lowry Nat. Ctr.
Box 270, Victoria,
MN 55386 (612) 472-4911
24. Luther Crest Camp
Rt. 5, W. Lake Carlos,
Alexandria, MN 56308
(612) 846-2431
25. Maplewood Nature Center
2659 E. 7th St., Maplewood,
MN 55119 (612) 738-9383
26. Minnesota Historical Soc.
(23 sites-write for info)
Ft. Snelling Hist. Ctr.,
St. Paul, MN 55111
(612) 726-1171
27. Minnesota Valley NWR
4101 E. 78th St.
Bloomington, MN 55420
(612) 854-5900
28. Minnesota Zoological Garden
12101 Johny Cake Rdg. Rd.
Apple Valley, MN 55124
(612) 432-9010
29. Mounds View North ELC
Rt.1, Bx 806, Britt, MN
55710 (612) 636-3650 X187
30. Murphy's Landing
2187 E. Hwy 101, Shakopee,
MN 55379 (612) 445-6900
31. New London NFH
P.O.Bx 304, New London,
MN 56273 (612) 354-2310
32. Northwoods Audubon Center
Rt.1, Sandstone, MN
55072 (612) 245-2648
33. North Woods Resource Ctr.
Camp Widjiwagan,HC#2,Bx654
Ely, MN 55371 (612)645-6605
34. Oliver Kelly Farm
15788 Kelley Farm Rd.,
Elk River, MN 55330
(612) 441-6896
35. Oxbow Nat. Ctr.
Rt.1, Bx 170, Byron, MN
55920 (507) 775-2451
36. Quarry Hill Nat. Ctr.
701 Silver Creek Rd.,
Rochester, MN 55904
(507) 281-6114
37. Red River Natural Hist. Area
U of M, Crookston, MN 56716
(218) 281-6510 Ext. 206
38. Red Wing Env. Learning Ctr.
Friedrich City Ctr., Red Wing,
MN 55066 (612) 388-7339
39. Barlage Center for Science
Moorhead State Univ.,
Moorhead, MN 56560
(218) 236-2904
40. Rice Lake NWR
Rt.2, McGregor, MN
55760 (218) 768-2402
41. Richardson Nat. Ctr.
8737 E. Bush Lake Rd.
Bloomington, MN 55438
(612) 941-7993
42. River Bend Nat. Ctr.
Bx 265, Faribault, MN
55021 (507) 332-7151
43. St. Croix Env. Ctr.
YMCA Camp St. Croix,
532 Co Rd F, Hudson, WI
54016 (612) 436-8428
44. St. Croix Wild River St. Pk., Rt.1, Bx 75
Center City, MN 55012
(612) 583-2125
45. Science Museum of MN
30 E. 10th St.
St. Paul, MN 55101
(612) 221-9488
46. Sherburne NWR
RR 2, Zimmerman, MN
55398 (623) 389-3323
47. Springbrook Nat. Ctr.
100 85th Ave. N.E.
Fridley, MN 55432
(612) 784-3854
48. Sibley St. Pk.
Rt. 2, Bx 600,
New London, MN 56273
(612) 354-2055
49. Tamarac NRW
RR, Rochert, MN 56578
(218) 847-2641
50. Tamarack Nat. Ctr.
2015 Van Dyke St.
Maplewood, MN 55109
(612) 429-7787
51. U of M Landscape Arboretum,
3675 Arboretum Dr.
Chaska, MN 55318
(612) 443-2460
52. Upper Miss. River Wildlife & Fish Refuge
51 E.4th St., Rm.101,
Winona, MN 55987
(507) 452-4232
53. Voyageur Nat'l Park
Bx 50, Int'l Falls, MN
56649 (218) 283-9821
54. Westwood Hills Env. Ed. Ctr., 8300 W. Franklin,
St. Louis Pk., MN 55426
(612) 924-2544
55. WMD Detroit Lakes
RR 3, Bx 47D, Detroit
Lakes, MN 56501
(218) 847-4431
56. WMD Fergus Falls
Rt.1, Bx 26A, Fergus
Falls, MN 56537
(218) 739-2291
57. WMD Litchfield
305 N. Sibley,
Litchfield, MN 56537
(612) 693-2849
58. WMD Morris
Rt.1, Bx 208,Mill Dam Rd.
Morris, MN 56267
(612) 589-1001
59. Wetlands,Pines,Prairie Audubon Sanctuary, RR2
Warren, MN 56762
(218) 745-4457
60. Whitewater St. Pk.
Rt.1, Bx 256, Altura, MN
55910 (507) 932-3007
61. Wilder Forest
14189 Ostlund Tr. N.,
Marine St. Croix, MN
55407 (612) 433-5198
62. Wolf Ridge E.L.C.
230 Cranberry Rd.,
Finland, MN 55603
(218) 353-7414
63. Wood Lake Nat. Ctr.
735 Lk. Shore Dr.,
Richfield, MN 55423
(612) 861-4507
64. Outdoor Program,U of M-Duluth
128 SpHC, 10 Univ. Dr, Duluth
MN 55812 (218) 726-7169

ABBREVIATIONS: (NWR)National Wildlife Refuge; (NF)National Forest: (St.Pk.)State Park; (Nat.Ctr.)Nature Center; (NFH)National Fish Hatchery; (Cons.)Conservation; (WMD)Wetland Management District; (ELC)Environmental Learning Center.

THEATRICS, INDIVIDUALS, PROGRAMS, ORGANIZATIONS
(Listed Alphabetically by Supplier)

CLIMB Theatre
500 N. Robert
Suite 220
St. Paul, MN 55101
(612)227-9660

Creative Drama residences various target groups on a variety of subjects. Residences from 1 - 12 weeks anywhere in Minnesota. Fees based on services requested.
Trash - a dramatic production to introduce concepts of waste reduction, reuse, and recycling. Available throughout Minnesota.

Energy Educators Association (EEA)
%Dr. Hameed G. Nezhad, President
302 Hagen Hall
Moorhead State University
Moorhead, MN 56560
(218)236-2463

EEA is a not-for-profit professional association. Its membership includes secondary school teachers, post-secondary school teachers, and professionals from energy-related businesses and government agencies. To be on the mailing list for the Newsletter and other information, contact the address above.

Land Stewardship Project
14758 Ostlund Trail North
Marine-on-St.-Croix, MN 55047
(612)433-2770

A Song for the Earth - a one-woman, one-act puppet show that can be staged for schools, churches, organizations, and clubs. $300 per performance plus expenses (travel, hotel, etc.,) for actress. Bookings handled through address above.

Olson, Dennis - Earthlore
31 South 17th Ave. East
Duluth, MN 55812
(218)724-7129

Lyceums available: "Critterman" (Animal Ecology); "Prof. Avian Guano" (Birds, Food Chain); "Mad Herbalist" (Plant Medicines); "Lost Voyageur" (Native Cultures); "Dr. Death" (Recycling, secondary only); "Prof. Loonacy" (Loons, Acid Rain); Workshops: Drama as a Teaching Tool. For further information, contact address above.

Wood, Doug - Earth Song
104 4th St. North
Sartell, MN 56377
(612)253-8211

Programs of environmentally-oriented music: guitar and song. Programs for school include audience participation.